Douglas Indian Association
Tribal Government

Box 240541 Douglas, Alaska 99824

March 1, 1999

The Unified Watershed Assessment Working Group (4503 F)
U. S. EPA
401 M. Street SW
Washington, DC 20460

Dear Working Group Chair:

The Douglas Indian Association, the federally recognized Indian Tribe of the Taku Kwaan of Southeast Alaska, hereby submits the Taku River Watershed Unified Watershed Assessment for your consideration.

The Taku River Watershed is a sub-watershed of the Lynn Canal, USGS Hydrologic Unit 19010301, and is classified as a "High Priority" Category 1 watershed. High Priority Category 1 classification is based on the fact that the watershed is the territorial homeland and center of the Taku Kwaan culture.

We appreciate the cooperation and assistance of Chuck Bell, State Conservationist, NRCS and Jim Caplan, Regional Forester, USFS in the development of this Unified Watershed Assessment. Additional technical assistance has been provided by the Southeast Conference RC&D, Tlingit and Haida Central Council, Alaska Department of Environmental Conservation, U.S. Geological Survey and the Environmental Protection Agency.

If you have any questions or comments, please contact Douglas Dobyns,

Environmental Planner, at (907) 364-3567.

Sincerely,

Frank Miyasato

Frank Miyasato

President

CC: (Without Enclosure)
Honorable Ted Stevens, U. S. Senator
Honorable Frank Murkowski, U. S. Senator
Honorable Don Young, U. S. Congressman
Honorable Tony Knowles, Governor, State of Alaska
Melvin Jack, Spokesman, Taku River Tlingit First Nation
Debra Vo, Executive Director, Alaska Inter-Tribal Council, Anchorage
Ed Thomas, President, Central Council of Tlingit and Haida
Linda Snow, Chairperson, Southeast Conference R C & D
Chuck Bell, State Conservationist, U. S. Natural Resources Conservation Service
Gordon Nelson, District Chief, U. S. Geological Survey

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DOUGLAS INDIAN ASSOCIATION

Unified Watershed Assessment, LYNN CANAL WATERSHED

USGS HYDROLOGIC UNIT 19010301, TAKU RIVER

Introduction

The Environmental Protection Agency and the U. S. Department of Agriculture issued the Clean Water Action Plan as the blueprint for fulfilling the original goal of the Clean Water Act. One of the first steps in the Plan is the opportunity for Tribes to submit Unified Watershed Assessments.

The Douglas Indian Association (DIA) is the federally recognized Indian Tribe of the Taku Kwaan of Southeast Alaska. The territorial homeland and center of their culture is the watershed of the Taku River. As such, the watershed is of the highest value and importance to the culture of DIA as compared to other watersheds in the Lynn Canal, Hydrologic Cataloging Unit 19010301.

Utilizing the watershed category criteria provided by the process, DIA has classified the Taku River watershed as a Category 1 watershed.

Based on the high cultural values and the Category 1 classification, DIA submits the Taku River watershed for the Unified Watershed Assessment – Clean Water Action Plan.

The following watershed summary description of the cultural and natural resources illustrates the value and need to restore and protect the Taku River watershed.

Watershed History

The Taku River was first explored in 1840 by James Douglas of the Hudson's Bay Company. The river was found to be difficult to ascend, and the site for a trading post was established at Taku Harbor instead. Although there is a relatively low altitude pass to the interior, the glacial terrain has discouraged settlement and transportation. Mining exploration from around the turn of the 20th Century resulted in a few claims that were worked from the late 1920s into the 1950s. The largest of these was the Tulsequah Chief, a copper, lead and zinc mine which transported its ore by road for about 7 miles, and then down the river by barge during summer high flow conditions. This mine ceased operation in the late 1950s, however the Redfern Mining Company has been approved to reopen mining operations, and take the ore out by road through Atlin, British Columbia.

The certification process has been contentious, and there are disagreements between the State of Alaska and British Columbia over the potential environmental impacts of the mine. In addition, on February 11th, 1999, the Taku River Tlingit First Nation filed suit against British Columbia under the Judicial Review Procedure Act (Docket A990300), over the way the Project Approval Certificate was issued.

Executive Summary

The Douglas Indian Association has classified the Taku River Watershed, a part of the Lynn Canal Watershed, Hydrologic Unit 19010301, as a Category I Watershed with a High Priority Rating. Water quality sampling in the river indicates regular exceedances of water quality standards for heavy metals, in both British Columbia and Alaska waters. In terms of both water chemistry and natural resource features, the area has a high sensitivity to the potential impacts of acid-rock mining.

This Unified Watershed Assessment documents these conditions, and gives information to characterize the river basin as an opportunity to restore the watershed, and to enhance the fisheries. The fisheries are managed presently by the Pacific Salmon Commission as a part of the Transboundary Rivers, with an annual yield in the millions of dollars for commercial harvest. The potential value of the entire fisheries may be in the tens of millions when the multipliers are considered, and the watershed has a high potential as an investment site for various types of non-intrusive tourism.

There are two indigenous governments which claim this area: the Taku River Tlingits of Atlin, British Columbia, and the Douglas Indian Association of Douglas, Alaska, a U. S. federally recognized Indian Tribe. A Judicial Review is pending in the British Columbia Supreme Court, in which the Taku River Tlingit First Nation is seeking relief from the Project Approval Certificate issued to Redfern Resources, Ltd. to reopen an abandoned copper mine on the Tulsequah River, a tributary to the Taku near the Alaska border.

The Taku River is close to Juneau, Alaska, and is considered important by the Governor and by the local people of Southeastern Alaska---for both its natural resources and for the aesthetics of the landscape. As a Transboundary River, there is a need for cooperative planning and negotiations of development proposals. There have been several requests for the involvement of the International Joint Commission to resolve outstanding issues, including those from the Governor of Alaska, and from the Douglas Indian Association Tribal Council. These requests have been supported by a number of interests, including commercial fisheries organizations, Tribal Governments, and public interest groups.

In addition to forwarding this document to the Unified Watershed Assessment Working Group of EPA, the Tribe is sending it out for agency review to both the federal and state agencies with an interest in the Taku River. Comments will be included that are sent in before the end of March, 1999, and will be forwarded to the EPA Working Group along with any responses that the Tribe may want to make.

Watershed Characteristics

Location

Taku Watershed, consisting of approximately 7,400 square miles, is located in southeast Alaska and extends into British Columbia, Canada. The mouth of the Taku River is approximately 12 miles south of the State's Capital, Juneau and drains into the Taku Inlet of the Pacific Ocean. Approximately 90 percent of the watershed lies in British Columbia, Canada (see attached location map).

Geology

The Boundary Ranges comprise the dominantly granitic mountains along the Alaska-British Columbia border. The highlands form mountainous transition belts lying between the high rugged granitic mountains along the Alaska Boundary and the Interior Plateaus.

The ranges have a core of intrusive granitic rocks which are flanked along the eastern margins by sedimentary and volcanic rock of the Paleozoic and the Mesozoic age. Granite is exposed along the axis of the range. Triassic and Jurassic greywackes and volcanic rock predominate the eastern contact of the batholith.

There are noticeable topographic differences between the erosion forms of the sedimentary and the granitic rock, the sedimentary tending to produce a sharp, more irregular topography than that of the granitic.

During the Pleistocene age the land was heavily loaded with ice, and near present coastline was submerged beneath the sea. Deposits of marine origin occur at elevations up to 100 feet above present sea level. Along the Taku River, there may be delta deposits of marine origin on terraces and benches up to the 500 foot level.

Soils

In light of the geology it is quite easy to understand the make up of soil types within the Taku River watershed. Aluvial deposits occur on the uplands and terraces and are made up of medium to coarse-grained sands and gravels and silts over lying compacted glacial till. Internal drainage is poor and near the mouth of the Taku is strongly affected by tidal influence. The coluvial material occurs at the foot slopes and benches and is predominately mineral in make up. Several classes of mucks and peats also appear within the watershed and occur at a variety of sites, predominately those with a severe inhibiting layer (i.e. bedrock or extremely compact till). The majority of soils found within the river plane are medium coarse to fine sands overlaying or inter-mixed with glacial till.

Hydrology

The Taku Watershed is located in Alaska and British Columbia. The portion in Alaska is approximately 900 square miles, and within Canada is approximately 6,500 square miles. Within the U.S. approximately 60%, or 540 square miles of the watershed is the snow and ice of the Juneau Icefield, and 40%, or 360 square miles, are mountain slopes and valley bottoms, including the floodplains of the river. The Taku River is one of only two rivers that cut through the coast range from the interior terrain of Canada, with the mouth of the river on the coast of Southeast Alaska. The lower 25 miles of the river are within the U.S.

Precipitation in the watershed at river level ranges from 120 at the coast to 60 inches at the border, and continues to decrease farther east to the headwaters of the watershed. As much as 260 inches fall annually on the 5000 feet ridgetops.

The mainstem of the river within the US is a broad, braided channel. The channel form is a dynamic result of the wide range of flows levels and the heavy sediment loads delivered to the river from glaciers. Runoff from the recently glaciated, poorly vegetated slopes is very rapid. The Tulsequah Glacier and River, located just upstream of the boarder, also strongly influences the Taku River's flow regime when the glacier dam breaks out, releasing enough water to double or triple the river's flow overnight. The highest instantaneous peak flow on the river was recorded from one of these events, at over 100,000 cfs. These peak flows move large wood that has accumulated during the lower more frequent flows, from the channel bottom to higher levels of the river banks and river bars, thus removing it as a source of habitat cover.

The river is rapidly aggrading as a result of the sized sediment delivered from four large glaciers in the U. S., and more in Canada. Sand and gravel sized sediment forms numerous river bars which move during high flows. During the summer months the river flow averages between 10,000 and 30,000 cfs, and carries a heavy load of fine "glacial flour" sediments.

During winter months when most headwaters are frozen the river flows drop to average less than 2000cfs, and can drop as low as 700 cfs. During these times wetlands become the last source of stored, unfrozen water that continue to feed the streams, and sites that maintain upwellings of groundwater become most critical for salmonid survival. Most of the wetlands capable of storing water are on the Canadian side of the boarder.

Groundwater upwellings occurs in areas of gravel deposition in the mainstem channel, near where streams flow into the river. These depositional areas are of high value for spawning habitat because of the abundant gravels. Of the 812 miles of stream in the U.S. portion of the watershed, 72% are in channel types which transport sediment from the mountain slopes, 12% are in transitional types, and 16% are in sediment deposition channel types such as estuaries, foodplains, and alluvial fans.

Within the U.S. portion of the watershed there are 812 miles of streams and rivers, 272 miles of which support anadromous fish, 115 miles support resident fisheries, and 425 support no fish, but are an essential part of the larger hydrological system.

Wetlands

Using descriptions consistent with Cowardin (1979), the Taku River watershed contains estuarine, riverine, palustrine and lacustrine wetland systems. Wetland conditions dominate inlet tidelands and valley floors throughout the watershed. Wetlands are also common on forested and scrub-shrub slopes, alpine depressions and lake fringe areas.

Estuarine systems provide valuable waterfowl and shorebird habitats as well as productive nursery sites for highly valuable Taku River salmon fisheries. These estuaries and lagoons have water chemistry affected by oceanic tides, precipitation and freshwater runoff. Both subtidal and intertidal estuarine systems are present as mud flats and submerged vascular plant aquatic beds. Common plants present at these sites include American dunegrass, sedges, wild celery, Alaskan orache, and goose tongue.

Riverine systems in the area are nearly all perennial. Western Hemlock and Sitka Spruce are the dominant riparian canopy species in the lower watershed within the United States, with shrub cover consisting of Devil's Club, Mountain Alder, Sitka Willow and Huckleberries. Skunk Cabbage, Western Marigold and sedges are common to emergent wetlands. Other herb species include Bluejoint Reedgrass, Horsetails, Oak Fern, Goatsbeard and Large Leafed Avens.

These riverine wetlands maintain the characteristic channel dynamics of the Taku River and provide dynamic water storage and energy dissipation. The biogeochemical functions of these riverine systems include nutrient spiraling, organic carbon export, particulate retention, and removal of imported elements and compounds. Habitat functions include the maintenance of vegetation, the maintenance of detrital biomass, and maintenance of aquatic dependent taxa.

Palustrine wetlands are the most numerous category of wetlands within the watershed. Although concentrated along the valley bottoms and toe slopes, scattered emergent and scrub-shrub palustrine systems have been identified in high elevation saddles, depressions and slopes. Dwarf shrub-low herbaceous plant communities occur within these "muskegs" and "meadows" consisting primarily of stunted Sitka spruce, black crowberry, roundleaf sundew, horsetail, sedges, cottonsedges, bluejoint reedgrass and sphagnum. The typical palustrine wetland on these landscapes have thick peat and mucky peat soils on slopes of 5% or greater. Surface and subsurface water storage and down gradient release of water from these wetlands is probably a significant source for maintaining a perennial streamflow in many tributaries. Other recognized hydrogeomorphic functions of these slope wetlands include elemental cycling, removal of imported elements and compounds, organic carbon export, and maintenance of integrity of the rhizosphere, which has significant erosion control benefits.

Various sized lacustrine systems are present throughout the watershed as low elevation outwash lakes and high elevation cirques.

Plants

A wide variety of plants exist within the Taku River watershed. Boreal forests of Sitka spruce, western hemlock, and black spruce are present. Alpine meadows and muskegs produce a variety of berries, mixed forbs, grasslands and sedge marshes. Alpine lichen and mosses dot the higher elevations. In lower elevations alder, various shrubs and willows line waterways.

Old growth stands of hemlock and spruce are scattered throughout the watershed. There are presently no plans for logging in the U. S. side of the watershed. However, should the proposed mining project go into effect, the opportunity for logging in British Columbia would exist, along with the inherent watershed impacts.

The Taku Kwaan are a subsistence people. The following is a list of subsistence plants that are found within the watershed. This is by no means an exhaustive list as there are many species that are used by traditional people that are not shared with the outside world.

Bearberries	Rhubarb
Black seaweed	Ribbon seaweed
Carrots	Rose hips
Crabapple	Rutabaga
Devil's Club	Salmonberries
Elderberry	Serviceberries
Fern roots	Skunk Cabbage
Fireweed	Soap Berries
Fox Tail	Swamp blueberry
Hairy Grass	Swamp currant
Hemlock	Thimble berries
High Bush Cranberries	Turnip
Hudson Bay Tea	Wild Celery
Jacob's berry	Wild Grey Currants
Kelp	Wild Raspberry
Light Blue Blueberries	Wild rice
Lowbush blueberries	Wild Strawberry
Mountain Blueberries	Wild Sweet Potato
Nagoon Berries	Yellow Cloudberries
Potatoes, wild	Yellow Sea Weed

Wildlife

A wide variety of wildlife species utilize habitats within the Taku watershed, including approximately 60 species of birds, 39 mammals and one (1) amphibian (Spotted frog).

Numerous passerines migrate through, and many nest within the area. Shorebirds utilize open water wetland areas during spring and summer months and raptors are common throughout the year. Several raptor species common to the area (Bald eagle, great horned owl, golden eagle, northern goshawk, gyrfalcon, northern harrier, and red-tailed hawk) are classified by the U.S. Fish and Wildlife Service as "sensitive species".

were studied in the mid-to-late 1980s. As result there is an initial understanding of the salmon habitat in these reaches of the Taku River.

Due to the cooperative management of the Transboundary Rivers, population dynamics are fairly well understood for most of the salmon species in the Taku River. A cooperative salmon enhancement program has been working as well. These are documented by publications of the Pacific Salmon Commission. The chum salmon population is less well known and has been depressed since the early 1980s. Some biologists have concerns that the hatchery production of chums from the Juneau area are depressing the wild stocks, due to competition for forage and habitat and by harvest rates that target on the more numerous hatchery adult population and take wild chum as well.

Canadian fisheries are managed through the Aboriginal Fisheries Strategy which gives the highest priority to subsistence fish harvests for TRTFN. The U. S. fisheries are currently managed by Alaska under a policy that gives highest priority to commercial fisheries and guided sports harvests, since the Taku River is considered an urban river by Alaskan Law. An on-going debate exists over the management of subsistence fisheries in the State of Alaska.

Although fish prices have fluctuated greatly, the annual value of the fisheries in the Taku River are in the millions of dollars, and potentially in the tens of millions of dollars when all of the multipliers are included.

Tlingit cultural values attached to the fish harvested go beyond economics. The Taku River watershed is an area where the Tlingit culture is as intact as any place in their traditional territory. A non-Native river culture is also present and has begun to develop its own local identity. In the Juneau area, the Taku River is also important to every sports fisher even if they have never been on it.

Water Quality

The Taku River watershed, the largest watershed within the USGS Cataloging Unit 19010301 encompassing approximately 7,400 square miles, has been classified as Category I and designated as a "high" priority watershed by the Douglas Indian Association.

Category 1 classification is based on water quality violations of state standards. It is believed that the long-term heavy metal contamination of copper, zinc and lead are related to mining activities. It is anticipated that without the implementation of restoration measures, violations of state standards for heavy metals will continue. Consequently the impacts will continue to degrade cultural and natural resources of the watershed.

Storet data have been evaluated and show consistencies with this finding.

However, we have not been able to recognize the sampling locations and laboratories used within Storet, and although the data is described as originating from USGS, both the Juneau and Anchorage Offices of USGS do not have records of this being the case. More recent data comes from the permit application process for the Redfern Mine at the old Tulsequah Chief site in British Columbia. This data was evaluated by Mehling Engineering for the British Columbia Ministry of Environment (1998). A copy of the summary table from that report is attached.

There is a joint five-year water quality project between USGS and the Douglas Indian Association that began sampling the Taku River at the USGS Gage in November, 1998. The samples are being processed by the EPA Manchester Laboratory in Washington. A Quality Assurance Project Plan exists, establishing the field and laboratory protocols, and in the sixth year the project calls for an interpretive report to be jointly written by USGS and the Douglas Indian Association. The purpose of this project is to establish base-line water quality data. The site of the gage (USGS 15041200) is approximately three miles downstream from the U. S./Canada Border, at 50 feet above sea level.

In consultation with the Alaska Department of Environmental Conservation, Douglas Indian Association was informed that Alaska DEC is considering placing the Taku River on their Draft 303(d) list for the year 2000, largely for the reasons stated above.

"High" priority rating is based on the watershed's high value to the Douglas Indian Association as their traditional territory and the center of the Subsistence Lifestyle and culture. Additional justification is based on the fact that the watershed is being proposed for referral to the IJC for an international hearing on the water quality concerns of Alaska, the United States and the Douglas Indian Association.

Subsistence

The Taku River is defined in Alaska State Law as a Non-Subsistence Area, and is managed for general hunting and fishing (including commercial). Statute 5 AAC 99.016 stipulates that *subsistence hunting and fishing regulations will not be adopted for these areas and the subsistence priority does not apply* (Eff. 5/15/93. Register 126). Under the Canadian Aboriginal Fishing Strategy the river is managed for subsistence priority, but the predominant harvest is taken by commercial in-river catch. The commercial fisheries are jointly managed under the Pacific Salmon Treaty, although in recent years there has been no agreement on final harvest shares. In the past, the river was important for the production of eulachon oil, dried salmon of several species, game, medicines, plant foods, and cultural materials for clothing and all other human needs. Trade was an active part of the subsistence economy, and in the last one hundred and fifty (plus) years included furs that added cash to the subsistence economy. There is an active subsistence economy still supporting Tlingit families, with mixtures of commercial fishing income and other resource-based incomes. In recent years a growing fisheries enhancement occupation has been able to employ Tlingits, and this is anticipated to grow as habitat evaluations show the needs and opportunities for further enhancement and habitat restoration. From the Native point of view, these occupations are a natural part of subsistence management.

Under an ANILCA Grant from BIA, the Douglas Indian Association will research and document the subsistence resources of the Taku River Basin over the next six months.

International Situation

The Taku River has been discussed as a potential road corridor over the years by both Alaska and the Province of British Columbia (BC), Canada. When Alaska was interested in the idea, British Columbia was not. Now that BC wants to permit a road through most of the watershed, Alaska is opposing the idea. The BC proposal is to provide a transportation route to re-open the Tulsequah Chief Mine that was in operation from 1930 through the 1950s. Alaska opposes the mine application due to environmental concerns. Alaska Governor Tony Knowles has requested to take the permitting issue to the International Joint Commission (IJC). The IJC was formed in 1909 to replace the International Waterways Commission as the chief way for water disputes to be resolved between the two countries. There is correspondence on this IJC referral from a variety of parties, but in general BC is opposed while the U.S. and Alaska are in favor.

The Taku River and its tributaries have been and continue to be the traditional use areas of the Taku Kwaan represented by the Douglas Indian Association, a federally recognized tribe under the Indian Reorganization Act, and the Taku River Tlingits First Nation of British Columbia (TRTFN).

The TRTFN, in the 1997 statement of intent for First Nation Land Claims, outline a corridor along the Taku River within Alaska that is approximately 30km wide stretching from the trans-boundary area to the mouth of the Taku Inlet.

TRTFN are negotiating their territorial claims at this time, and on February 11, 1999 filed suit against BC over the way that the certification for the mine was issued. The Douglas Indian Association have passed Council Resolutions in support of TRTFN and have received supporting Resolutions and letters from other Tribes and Tribal Organizations.

The fact that the watershed is traditional Tlingit homeland and a source of cultural existence amplifies the Tlingit concern for the health of the river and its watershed.

Process & Participants

Douglas Indian Association requested and received the technical assistance of the Natural Resources Conservation Service and the U.S. Forest Service to produce this Unified Watershed Assessment of the Taku River watershed. Two meetings were held with representatives of the Douglas Indian Association to complete the assessment. Southeast Conference Resource Conservation & Development Council has provided process facilitation support to Douglas Indian Association.

Technical assistance has also been provided by Alaska Department of Environmental Conservation, USGS, EPA and Chris Rowe, Environmental Planner for the Central Council of Tlingit and Haida Indian Tribes of Alaska.

References

Watershed History

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Watershed Characterization

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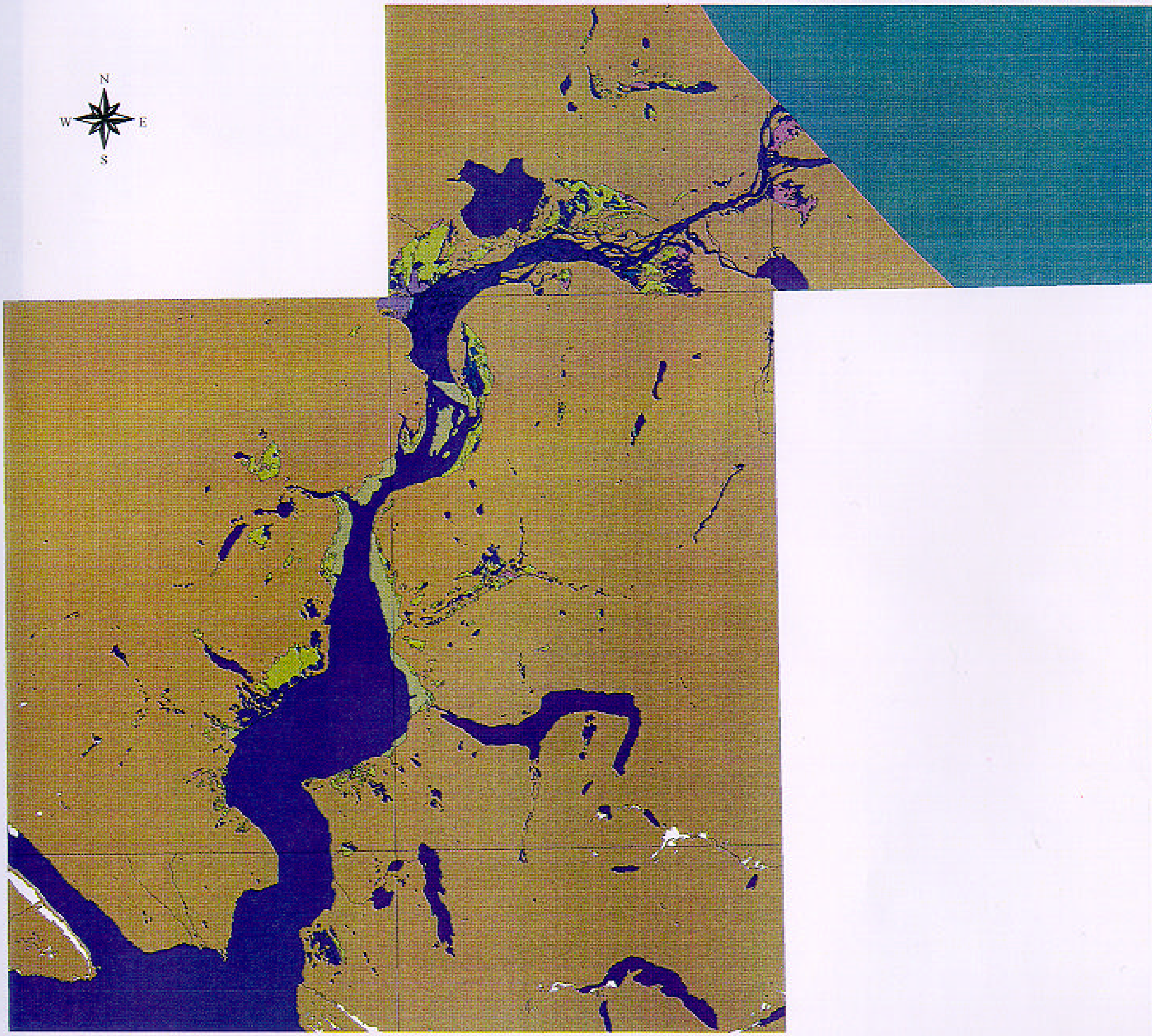
International Situation

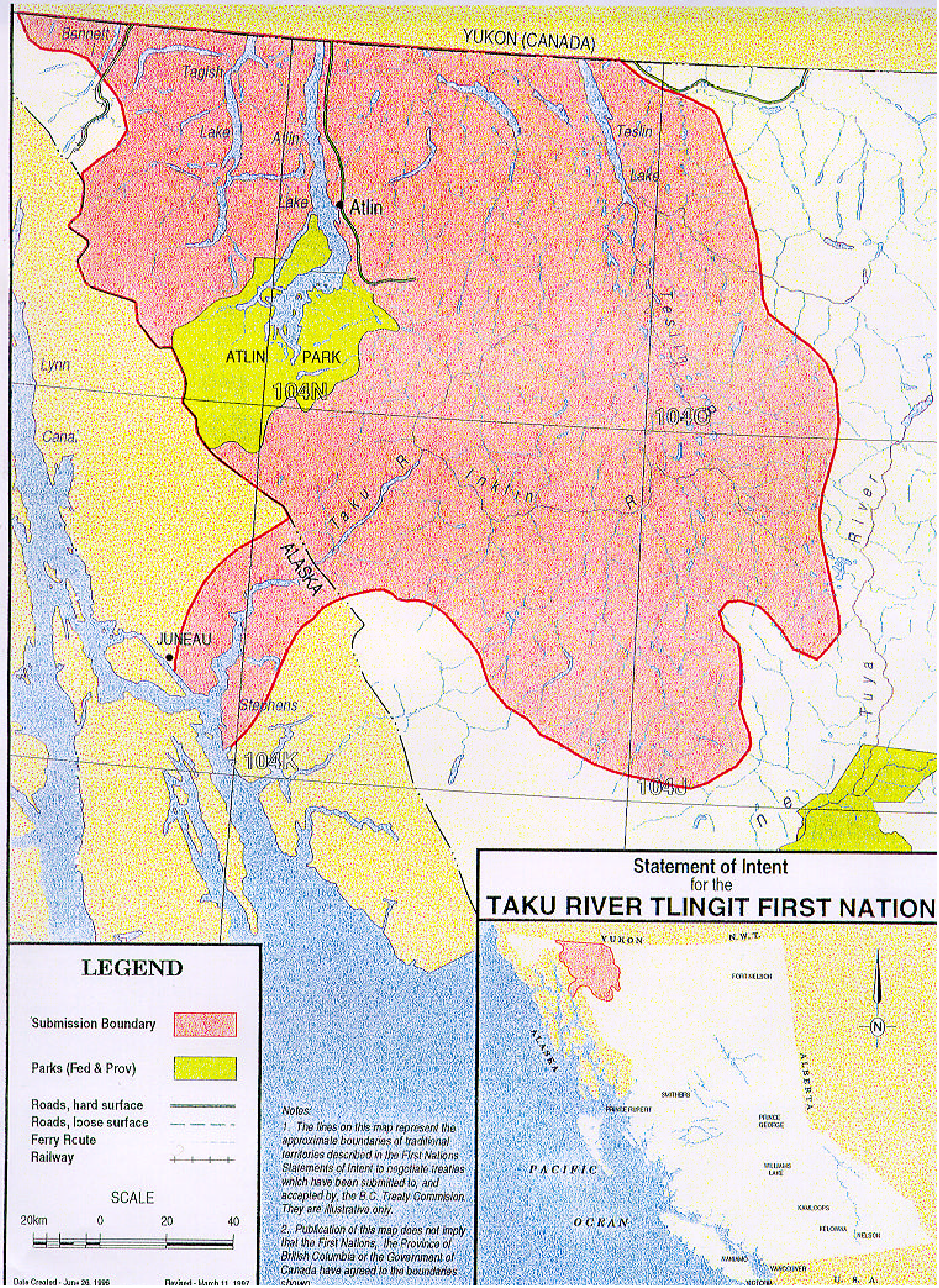
Correspondence from Alaska's Governor Tony Knowles; Resolutions and letters of the Douglas Indian Association; Press Releases of the Taku River Tlingit First Nation.



Taku Watershed Wetlands Projectior

Douglas Indian Association
Unified Watershed Assessment
March 1, 1999

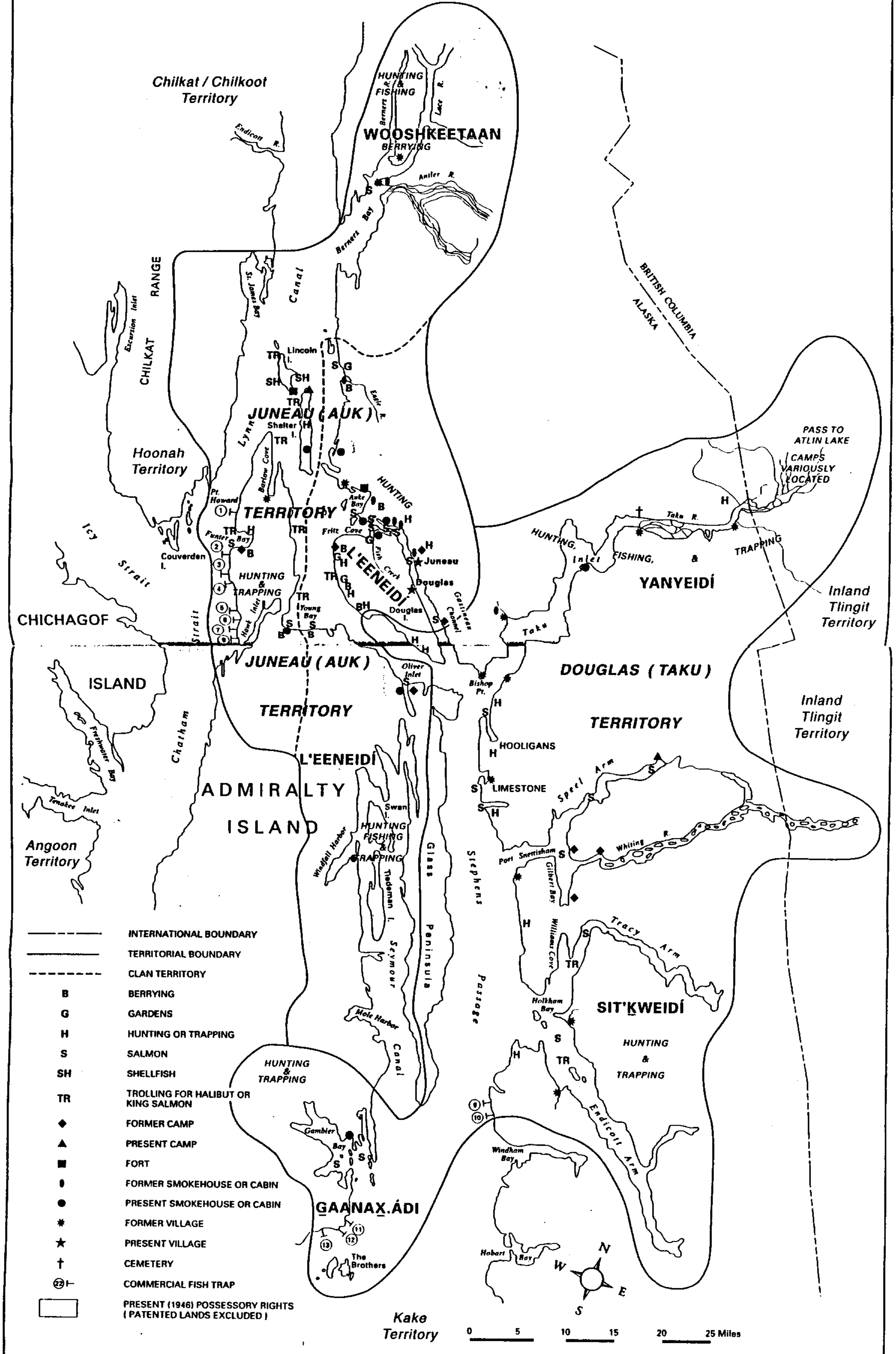
- Waterways
- Uplands
- British Columbia
- Wetlands



Statement of Intent
for the
TAKU RIVER TLINGIT FIRST NATION
YUKON (CANADA)
Bennett
Tagish
Lake
Atlin
Lake
Atlin
Teslin
Lake
Teslin
ATLIN PARK
104N
104O
Lynn
Canal
Taku R
Inklin R
ALASKA
JUNEAU
Stephens
104K
104J
River
Tuya
LEGEND
Submission Boundary
Parks (Fed & Prov)
Roads, hard surface
Roads, loose surface
Ferry Route
Railway
SCALE
20km
0
20
40
Notes:
1. The lines on this map represent the approximate boundaries of traditional territories described in the First Nations Statements of Intent to negotiate treaties which have been submitted to, and accepted by, the B.C. Treaty Commission. They are illustrative only.
2. Publication of this map does not imply that the First Nations, the Province of British Columbia or the Government of Canada have agreed to the boundaries shown.
YUKON
N.W.T.
ALASKA
ALBERTA
PACIFIC
OCEAN
N

Chart 6: JUNEAU-DOUGLAS TERRITORY

SHOWING ABORIGINAL USE AND OWNERSHIP
AND PRESENT (1946) USES



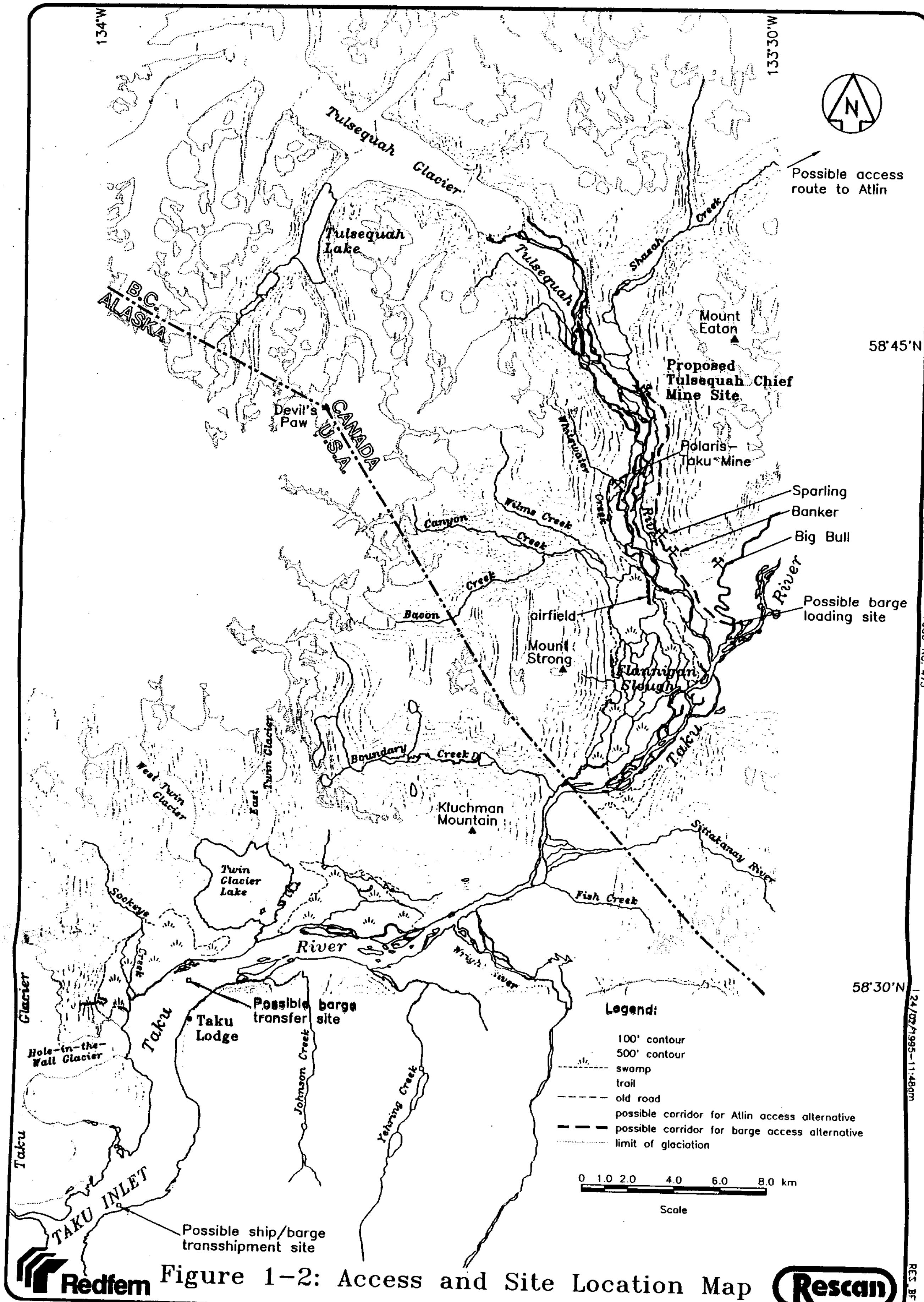


Figure 1-2: Access and Site Location Map

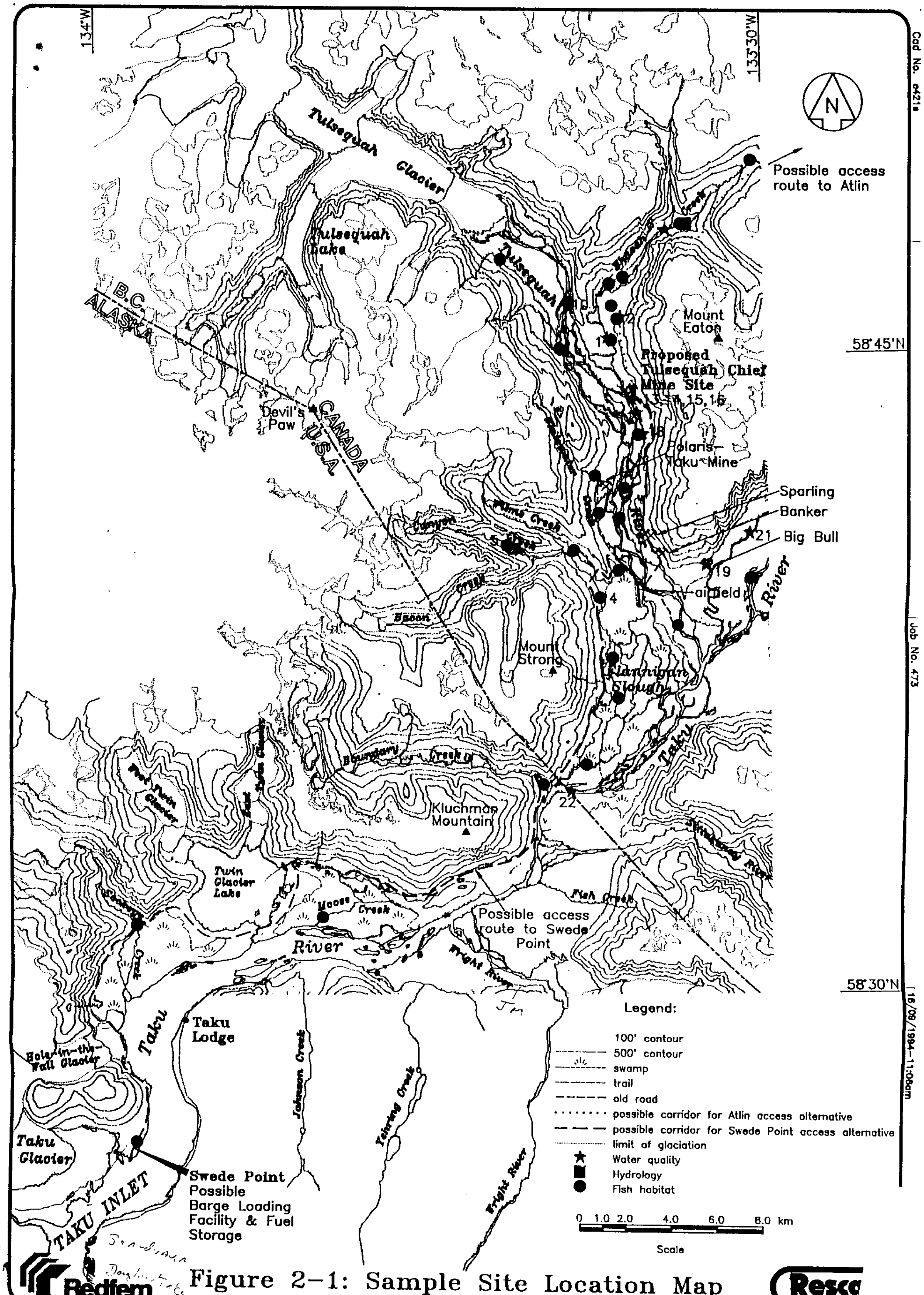


Figure 2-1: Sample Site Location Map

Tulsequah Chief Project: Cumulative Water Quality Effects

TABLE A2: Existing and Predicted Loadings and Concentrations - Zinc

Site	Estimated Catchment	Dissolved Loadings (mg/sec)				Total Loadings (mg/sec)				Flows (m^3/sec)				Dissolved Zinc (ug/L)				Total Zinc (ug/L)			
		Jan/Feb	Mar - June	July/Aug	Sept - Dec	Jan/Feb	Mar - June	July/Aug	Sept - Dec	Jan/Feb	Mar - June	July/Aug	Sept - Dec	Jan/Feb	Mar - June	July/Aug	Sept - Dec	Jan/Feb	Mar - June	July/Aug	Sept - Dec
Upstream Background Sites:																					
Upstream Taku River (W21)	15,500 km^2	1447.1	7875	12480	3668	1846	14625	40768	72574	49.9	375	832	262	29	21	15	14	37	39	49	277
max														54	127	26	49	55	129	64	1350
min														4	<1	<1	<1	19	<1	41	3
count														2	9	3	5	2	9	3	5
Upstream Tulsequah River (W10)	630 km^2	21	87	177	52	59	230	2246	514	3.1	23	104	23.7	6.9	3.8	1.7	2.2	19	10	21.6	21.7
max														11	15	3	6	40	30	34	39
min														<1	<1	<1	<1	10	<1	17	7
count														4	14	5	10	4	14	5	10
Existing Discharges:																					
Big Bull Mine Discharge (W19)		31	10	21	38	32	10	23.1	44	0.002	0.002	0.002	0.002	15420	4754	10400	19026	15985	5211	11550	21776
max														23000	8730	11400	31900	24000	8750	12400	38100
min														7840	2120	9230	4380	7970	3040	9590	4880
count														2	9	4	5	2	9	4	5
Canarc Expl. Discharge		1	1	1	1	0	0.6	1	1	0.0366	0.0366	0.0366	0.0366	14	17	17	17	13	17	17	17
max														19	31			21	62		
min														6	10			7	5		
count														3	30			3	30		
Whitewater Creek Tailings		0	4	20	13	0	4.0	26	15	0.015	0.110	0.510	0.113		34	39	117		36	51	131
max															49	73	185		49	85	212
min															20	5	69		23	5	9
count															6	7	7		6	7	7
Old Tulsequah Chief		821	821	821	821	976	976	976	976	0.013	0.013	0.013	0.013								
- 5400 Adit														60050				66690			
- 5200 Adit														44920				51660			
Predicted Tulsequah Discharges:																					
(Replacing Old Tulsequah Chief Discharges)																					
Tailings Pond Seepage (TPS)		11	11	11	11	11	11	11	11	0.116	0.116	0.116	0.116	94	94	94	94	94	94	94	94
Treated Effluent (TrPl)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.0467	0.0467	0.0467	0.0467	12	12	12	12	12	12	12	12
Worst Flow and Permit Conditions:																					
Canarc Expl. Discharge		12	12	12	12	30	30	30	30	0.06	0.06	0.06	0.06	200	200	200	200	500	500	500	500
Tulsequah Treated Effluent (TrPl)		12.1	12.1	12.1	12.1	30	30	30	30	0.0606	0.0606	0.0606	0.0606	200	200	200	200	500	500	500	500
Existing Downstream Site:																					
Taku River @ Canada/US Border (W22)	17,700 km^2	741	3852	4085	1170	2109	8988	25080	5820	57	428	950	300	13	9	4.3	3.9	37	21	26.4	19.4
max														25	43	6	11	66	47	50	73
min														1	<1	<1	<1	8	4	5	3
count														2	11	5	7	2	11	5	7
Existing Downstream Site		741	3852	4085	1170	2109	8988	25080	5820												
Summary of Upstream Background Sites		1468	7962	12657	3720	1905	14855	43014	73088												
Summary of Existing Mine Discharges		852	835	862	873	1008	991	1026	1035												
Sum of Predicted and Continued Existing Mine Discharges		43	25	53	63	44	26	61	70												
Summary of Max. Potential Mine Discharges		66	48	76	86	103	86	120	130												
Changes in Loadings from Mines:																					
Ratio: Sum of Existing/Sum of Predicted		20	33	16	14	23	37	17	15												
Ratio: Sum of Existing/Sum of Max. Pot.		13	17	11	10	10	12	9	8												
Prediction of Border Loadings:																					
Ratio: (Sum of Background + Existing)/Existing Border		3.1	2.3	3.3	3.9	1.4	1.8	1.8	12.7												
Existing Border Loadings		741	3852	4085	1170	2109	8988	25080	5820												
Predicted Border with Predicted Mine Discharges		483	3498	3840	964	1411	8441	24531	5744												
Predicted Border with Max . Pot. Mine Discharges		490	3508	3847	970	1454	8474	24564	5749												

	Dissolved Zinc (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec	Total Zinc (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec
Existing Border Concentrations	13	9	4.3	3.9	37	21	26.4	19.4
CCREM Receiving Water Criteria	30	30	30	30	30	30	30	30
Alaskan Most Stringent*	36	36	36	36	36	36	36	36
Hardness (mg/L CaCO3) at Border	102	96	42	63	102	96	42	63

* from US EPA, Nov. 6, 1997 letter to EAO, assuming hardness of 25 mg/L

	Dissolved Zinc (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec	Total Zinc (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec
Existing Border Concentrations	13	9	4.3	3.9	37	21	26.4	19.4
Predicted Border with Predicted Mine Discharges	8.5	8.2	4.0	3.2	24.8	19.7	25.8	19.1
Predicted Border with Max . Pot. Mine Discharges	8.6	8.2	4.0	3.2	25.5	19.8	25.9	19.2

Tulsequah Chief Project: Cumulative Water Quality Effects
TABLE A1: Existing and Predicted Loadings and Concentrations - Copper

Site	Estimated Catchment	Dissolved Copper Loadings (mg/sec) Jan/Feb	Mar - June	July/Aug	Sept - Dec	Total Copper Loadings (mg/sec) Jan/Feb	Mar - June	July/Aug	Sept - Dec	Flows (m^3/sec) Jan/Feb	Mar - June	July/Aug	Sept - Dec	Dissolved Copper (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec	Total Copper (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec
Upstream Background Sites:																					
Upstream Taku River (W21)^	15,500 km^2	504	1650	1331	655	838	4800	11149	38514	49.9	375	832	262	10.1	4.4	1.6	2.5	16.8	12.8	13.4	147
max														20	21.7	3.1	11.2	30	34.2	23.6	712
min														<0.4	0.7	<0.4	<0.5	3.6	1.6	5.7	1.3
count														2	9	3	5	2	9	3	5
Upstream Tulsequah River (W10)	630 km^2	7	46	45	13	35	205	790	192	3.1	23	104	23.7	2.1	2.0	0.43	0.54	11.2	8.9	7.6	8.1
max														7.6	10.6	0.8	1.4	19.8	62.4	9.8	18.5
min														<0.4	<0.4	<0.3	<0.4	7.4	<0.4	3.9	1.0
count														4	14	5	10	4	14	5	10
Existing Discharges:																					
Big Bull Mine Discharge (W19)		6	1	1	7	6	1.4	1.3	8.6	0.002	0.002	0.002	0.002	2823	346	314	3403	2825	715	641	4297
max														5100	563	495	5710	5100	1410	991	6590
min														547	119	170	412	551	131	452	787
count														2	9	4	5	2	9	4	5
Canarc Expl. Discharge		0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.0366	0.0366	0.0366	0.0366	2	2.4	2.4	2.4	2	6	6	6
max										0.0511	0.0530			3	8			3	36		
min										0.0455	0.0379			1	1			1	1		
count										2	24			3	30			3	30		
Whitewater Creek Tailings		0.1	0.3	1.0	0.7	0	1	2	1	0.015	0.110	0.510	0.113	6	3	2	6		5	4	11
max															4	4	10		9	8	23
min															1	1	1		3	1	7
count															6	7	7		6	7	7
Old Tulsequah Chief		218	218	218	218	244	244	244	244	0.013	0.013	0.013	0.013								
- 5400 Adit														17360	17360	17360	17360	17410	17410	17410	17410
- 5200 Adit														10642	10642	10642	10642	11188	11188	11188	11188
Predicted Tulsequah Discharges:																					
(Replacing Old Tulsequah Chief Discharges)																					
Tailings Pond Seepage (TPS)		4	4	4	4	4	4	4	4	0.116	0.116	0.116	0.116	35.0	35.0	35.0	35.0	35.0	35.0	35.0	35.0
Treated Effluent (TrPl)		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.0467	0.0467	0.0467	0.0467	9.83	9.83	9.83	9.83	9.83	9.83	9.83	9.83
Worst Flow and Permit Conditions:																					
Canarc Expl. Discharge		3.0	3.0	3.0	3.0	18	18	18	18	0.06	0.06	0.06	0.06	50	50	50	50	300	300	300	300
Tulsequah Treated Effluent (TrPl)		3.0	3.0	3.0	3.0	18	18	18	18	0.0606	0.0606	0.0606	0.0606	50	50	50	50	300	300	300	300
Existing Downstream Site:																					
Taku River @ Canada/US Border (W22)	17,700 km^2	262	1156	5700	420	741	3124	12730	2490	57	428	950	300	4.6	2.7	6	1.4	13	7.3	13.4	8.3
max														9.0	9.4	27.3	3.5	22	14.7	29.1	35.6
min														<0.4	<0.5	<0.3	<0.4	3.7	1.1	3.8	<0.4
count														2	11	5	7	2	11	5	7

Site	Dissolved Copper Loadings (mg/sec) Jan/Feb	Mar - June	July/Aug	Sept - Dec	Total Copper Loadings (mg/sec) Jan/Feb	Mar - June	July/Aug	Sept - Dec
Existing Downstream Site	262	1156	5700	420	741	3124	12730	2490
Summary of Upstream Background Sites	511	1696	1376	668	873	5005	11939	38706
Summary of Existing Mine Discharges	224	219	220	226	250	246	248	254
Sum of Predicted and Continued Existing Mine Discharges	10	6	6	12	10	7	8	15
Summary of Max. Potential Mine Discharges	16	11	12	18	46	42	44	50

	Dissolved Copper (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec	Total Copper (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec
Existing Border Concentrations	4.6	2.7	6	1.4	13	7.3	13.4	8.3
CCREM Receiving Water Criteria	2	2	2	2	2	2	2	2
Alaskan Most Stringent*	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62
Hardness (mg/L CaCO3) at Border	102	96	42	63	102	96	42	63

* from US EPA, Nov. 6, 1997 letter to EAO, assuming hardness of 25 mg/L

^ includes Sept. 15, 1995 total copper outlier result for Upstream Taku River

	Dissolved Copper Loadings Jan/Feb	Mar - June	July/Aug	Sept - Dec	Total Copper Loadings Jan/Feb	Mar - June	July/Aug	Sept - Dec
Changes in Loadings from Mines:								
Ratio: Sum of Existing/Sum of Predicted	22	39	35	19	24	37	31	17
Ratio: Sum of Existing/Sum of Max. Pot.	14	20	19	13	5	6	6	5
Prediction of Border Loadings:								
Ratio: (Sum of Background + Existing)/Existing Border	2.8	1.7	0.3	2.1	1.5	1.7	1.0	15.6
Existing Border Loadings	262	1156	5700	420	741	3124	12730	2490
Predicted Border with Predicted Mine Discharges	186	1027	4937	320	583	2982	12480	2475
Predicted Border with Max . Pot. Mine Discharges	188	1030	4957	322	606	3003	12517	2477

	Dissolved Copper (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec	Total Copper (ug/L) Jan/Feb	Mar - June	July/Aug	Sept - Dec
Existing Border Concentrations	4.6	2.7	6.0	1.4	13	7.3	13.4	8.3
Predicted Border with Predicted Mine Discharges	3.3	2.4	5.2	1.1	10.2	7.0	13.1	8.2
Predicted Border with Max . Pot. Mine Discharges	3.3	2.4	5.2	1.1	10.6	7.0	13.2	8.3

Tulsequah Chief Project: Cumulative Water Quality Effects

TABLE A4: Existing and Predicted Loadings and Concentrations - Lead

Site	Estimated Catchment	Dissolved Loadings (mg/sec)				Total Loadings (mg/sec)				Flows (m^3/sec)				Dissolved Lead (ug/L)				Total Lead (ug/L)			
		Jan/Feb	Mar - June	July/Aug	Sept - Dec	Jan/Feb	Mar - June	July/Aug	Sept - Dec	Jan/Feb	Mar - June	July/Aug	Sept - Dec	Jan/Feb	Mar - June	July/Aug	Sept - Dec	Jan/Feb	Mar - June	July/Aug	Sept - Dec
Upstream Background Sites:																					
Upstream Taku River (W21)	15,500 km^2	10.978	213.75	99.84	68.12	35	900	3411.2	733.6	49.9	375	832	262	0.22	0.57	0.12	0.26	0.7	2.4	4.1	2.8
max														0.4	1.6	0.2	1.0	0.8	4	5.4	8.6
min														<0.1	<0.1	<0.1	<0.1	0.5	<0.1	2.2	0.2
count														2	9	3	5	2	9	3	5
Upstream Tulsequah River (W10)	630 km^2	1.6	6.0	13.5	3.3	4	39	260	66	3.1	23	104	23.7	0.5	0.26	0.13	0.14	1.2	1.68	2.5	2.8
max														0.9	1.0	0.3	0.3	2.4	6.0	3.7	8.0
min														0.1	<0.06	<0.08	<0.1	0.3	<0.1	1.8	0.3
count														4	14	5	10	4	14	5	10
Existing Discharges:																					
Big Bull Mine Discharge (W19)		0.1	0.1	0.0	0.4	0.3	0.4	0.14	0.6	0.002	0.002	0.002	0.002	71.3	71.2	3.8	180	127	219	70	303
max														100	352	6	303	210	845	150	386
min														42.6	1.1	2.4	2.4	43.7	1.6	21.8	109
count														2	9	3	5	2	9	4	5
Canarc Expl. Discharge		0.0	0.1	0.1	0.1	0.0	0.1	0.1	0.1	0.0366	0.0366	0.0366	0.0366	1	2			1	2		
max														1	16			1	10		
min														1	1			1	1		
count														3	3			3	30		
Whitewater Creek Tailings		0.0	0.1	0.5	0.2	0.0	0.2	1.0	0.7	0.015	0.110	0.510	0.113		1	1	2		2	2	6
max															1	2	4		4	6	14
min															1	1	1		1	1	2
count															6	7	7		6	7	7
Old Tulsequah Chief		3.5	3.5	3.5	3.5	5.7	5.7	5.7	5.7	0.013	0.013	0.013	0.013								
- 5400 Adit														300				480			
- 5200 Adit														108				146			
Predicted Tulsequah Discharges:																					
(Replacing Old Tulsequah Chief Discharges)																					
Tailings Pond Seepage (TPS)		0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.116	0.116	0.116	0.116	5.0	5.0	5.0	5.0	5.0	5.0	5.0	5.0
Treated Effluent (TrPl)		0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.0467	0.0467	0.0467	0.0467	0.74	0.74	0.74	0.74	0.74	0.74	0.74	0.74
Worst Flow and Permit Conditions:																					
Canarc Expl. Discharge		2	2	2	2	6	6	6	6	0.06	0.06	0.06	0.06	30	30	30	30	100	100	100	100
Tulsequah Treated Effluent (TrPl)		2	2	2	2	6	6	6	6	0.0606	0.0606	0.0606	0.0606	30	30	30	30	100	100	100	100
Existing Downstream Site:																					
Taku River @ Canada/US Border (W22)	17,700 km2	7	60	542	36	46	574	2470	600	57	428	950	300	0.125	0.14	0.57	0.12	0.8	1.34	2.6	2.0
max														0.2	0.4	2.4	0.5	1.1	3.6	4.2	9.0
min														<0.1	<0.1	<0.1	<0.07	0.5	<0.1	1.8	<0.1
count														2	11	5	7	2	11	5	7
Existing Downstream Site		7	60	542	36	46	574	2470	600	Existing Border Concentrations				0.125	0.14	0.57	0.12	0.8	1.34	2.6	2.0
Summary of Upstream Background Sites		12.5	219.7	113.4	71.4	38.7	938.6	3671.2	800.0	CCREM Receiving Water Criteria				2	2	2	2	2	2	2	2
Summary of Existing Mine Discharges		3.7	3.8	4.1	4.2	6.0	6.4	6.9	7.1	Alaskan Most Stringent*				0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Sum of Predicted and Continued Existing Mine Discharges		0.8	0.9	1.2	1.3	0.9	1.3	1.8	2.0	Hardness (mg/L CaCO3) at Border				102	96	42	63	102	96	42	63
Summary of Max. Potential Mine Discharges		4.3	4.5	4.7	4.8	12.9	13.3	13.8	13.9	* from US EPA, Nov. 6, 1997 letter to EAO, assuming hardness of 25 mg/L											
Changes in Loadings from Mines:																					
Ratio: Sum of Existing/Sum of Predicted		4.6	4.1	3.4	3.3	6.6	4.8	3.8	3.6												
Ratio: Sum of Existing/Sum of Max. Pot.		0.8	0.9	0.9	0.9	0.5	0.5	0.5	0.5												
Prediction of Border Loadings:																					
Ratio: (Sum of Background + Existing)/Existing Border		2.3	3.7	0.2	2.1	1.0	1.6	1.5	1.3												
Existing Border Loadings		7	60	542	36	46	574	2470	600	Existing Border Concentrations				0.125	0.14	0.57	0.12	0.8	1.34	2.6	2.0
Predicted Border with Predicted Mine Discharges		5.9	59	528	35	40	570	2467	596	Predicted Border with Predicted Mine Discharges				0.10	0.14	0.56	0.12	0.7	1.3	2.6	2.0
Predicted Border with Max . Pot. Mine Discharges		7.4	60	544	36	53	578	2475	605	Predicted Border with Max . Pot. Mine Discharges				0.13	0.14	0.57	0.12	0.9	1.3	2.6	2.0

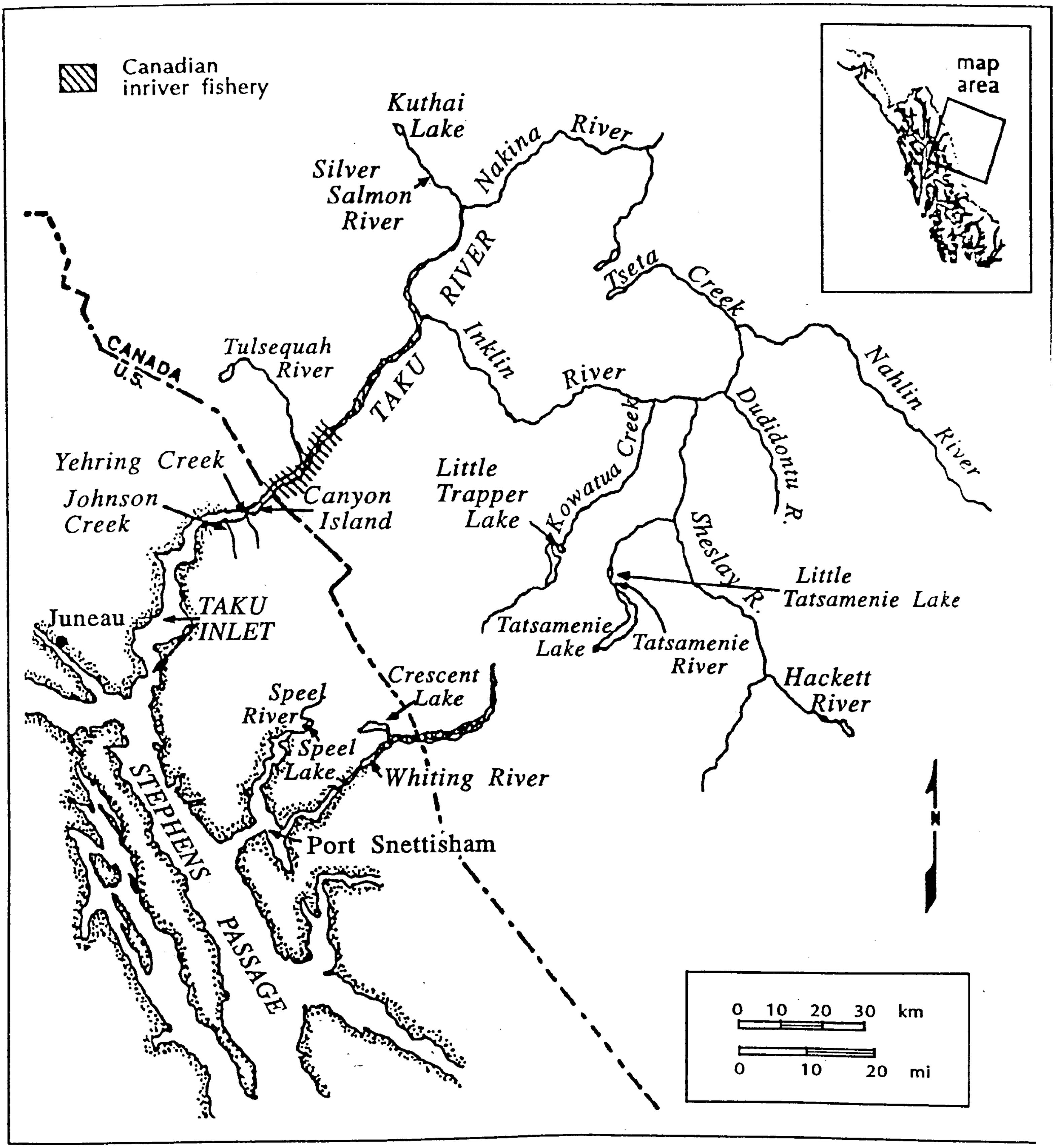


Figure 1.–Taku Inlet and Taku River drainage.

VANCOUVER
FEB 11 1999
REGISTRY

FORM 125
RULE 65

A990300

No. ________
Vancouver Registry

IN THE SUPREME COURT OF BRITISH COLUMBIA

BETWEEN:

THE TAKU RIVER TLINGIT FIRST NATION and MELVIN JACK, on behalf of himself and all other members of the Taku River Tlingit First Nation

PETITIONERS

AND

NORM RINGSTAD, in his capacity as the Project Assessment Director for the Tulsequah Chief Mine Project, SHEILA WYNN, in her capacity as the Executive Director, Environmental Assessment Office, THE MINISTER OF ENVIRONMENT, LANDS AND PARKS and THE MINISTER OF ENERGY AND MINES AND MINISTER RESPONSIBLE FOR NORTHERN DEVELOPMENT

RESPONDENTS

OUTLINE

Nature of the Application:

This is an application pursuant to the *Judicial Review Procedure Act* with respect to the exercise of statutory powers of decision respecting an environmental review and the issuance of a Project Approval Certificate pursuant to the *Environmental Assessment Act*, RSBC 1996, c. 119 (the "*Act*").

The subject of that review and Certificate was a proposal by Redfern Resources Ltd. to re-open a mine on the Taku River system and to build a 160 km access road through an unroaded and pristine wilderness area in northwestern British Columbia, from Atlin to Tulsequah.

The area to be traversed and impacted by the proposed road is the portion of the traditional territory of the Taku River Tlingit First Nation where their traditional land use activities - particularly the hunting, fishing and gathering on which they heavily rely - are most concentrated. The Tlingits participated fully in the environmental review. The information gathered through that process showed that by opening up that portion of the territory, the

- For the reasons in (1), it was not the product of an environmental review process within the contemplation of the *Act*;
- It did not make the substantive decisions required by the *Act*, because it did not analyse and advise on the potential effects of the Project or on the prevention or mitigation of the adverse effects that would be caused by the Project;
- The recommendations were not based on the decision required by the *Act*, viz., whether the Project would promote sustainability by protecting the environment and fostering a sound economy and social well-being; and
- The analyses and recommendations were decided by a few government officials rather than by the project committee.

3. The Referral of Redfern's application to the Ministers did not conform to the purposes or satisfy the requirements of the *Act* because, for the reasons in (1) and (2), the environmental review of the Project and the Recommendations Report did not provide the Ministers with the information required for the proper exercise of their discretion under the *Act*.

4. The Certificate did not conform to the purposes or satisfy the requirements of the *Act* because:
- The Project will not promote sustainability by protecting the environment and fostering a sound economy and social well-being; and
- It was not based on an environmental review and Recommendations Report within the contemplation of and required by the *Act*.

5. The Ministers erred in law when they decided to issue the Certificate because:
- They considered irrelevant matters, viz., what they thought were the majority views of the project committee, rather than the substance of the issues raised by the review and relevant to the decision whether to issue the Certificate;
- They did not consider all relevant matters, viz., the matters raised in the Recommendations Report prepared for them by the Tlingit member of the project committee;
- They reached patently unreasonable conclusions that are not supported by the information and analyses gathered through the environmental review process; and
- The Certificate approves a Project that will undermine rather than achieve the dominant purpose of the *Act*, viz., the promotion of sustainability by protecting the environment and fostering a sound economy and social well-being.

6. The Tlingits' hunting, fishing, gathering and other traditional land use activities in the portion of their traditional territory that will be traversed and impacted by the proposed road are the exercise of aboriginal rights within s. 35 of the *Constitution Act, 1982*. The Certificate approves a Project that will unjustifiably infringe on the Tlingits' exercise of those rights.

7. The Tlingits have aboriginal rights within s. 35 of the *Constitution Act, 1982*, based on their aboriginal title to the site of Redfern's proposed mine and the portions of their territory that would be traversed and impacted by the road. The title of the

- David Shackleton, sworn the 3rd day of February, 1999;
- Francois Messier, sworn the 3rd day of February, 1999;
- Brian Horejsi, sworn the 8th day of February, 1999;
- Richard Salter, sworn the 3rd day of February, 1999;
- Margot Venton, sworn the 5th day of February, 1999;

Dated: February 11, 1999

Petitioners' Solicitor

This Outline is filed by Arthur Pape, of the Law Firm of Pape and Salter, Barristers and Solicitors, 460 - 220 Cambie Street, Vancouver, B.C. V6B 2M9. (Tel - 604-681-3002; Fax - 604-681-3050)

TABLE 5: Existing and Predicted Border Concentrations

	Dissolved Metal (ug/L)				Total Metal (ug/L)			
	Jan/Feb	Mar - June	July/Aug	Sept - Dec	Jan/Feb	Mar - June	July/Aug	Sept - Dec
COPPER:								
Existing Border Concentrations	4.6	2.7	6.0	1.4	13	7.3	13.4	8.3
Predicted Border with Predicted Mine Discharges	3.3	2.4	5.2	1.1	10.2	7.0	13.1	8.2
Predicted Border with Max . Pot. Mine Discharges	3.3	2.4	5.2	1.1	10.6	7.0	13.2	8.3
CCREM/BC Receiving Water Criteria	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Alaskan Most Stringent*	3.62	3.62	3.62	3.62	3.62	3.62	3.62	3.62
ZINC:								
Existing Border Concentrations	13	9	4.3	3.9	37	21	26.4	19.4
Predicted Border with Predicted Mine Discharges	8.5	8.2	4.0	3.2	24.8	19.7	25.8	19.1
Predicted Border with Max . Pot. Mine Discharges	8.6	8.2	4.0	3.2	25.5	19.8	25.9	19.2
CCREM/BC Receiving Water Criteria	30	30	30	30	30	30	30	30
Alaskan Most Stringent*	36	36	36	36	36	36	36	36
CADMIUM:								
Existing Border Concentrations	0.05	0.07	0.07	0.14	0.15	0.12	0.37	0.22
Predicted Border with Predicted Mine Discharges	0.03	0.06	0.07	0.13	0.10	0.11	0.37	0.21
Predicted Border with Max . Pot. Mine Discharges	0.04	0.07	0.07	0.13	0.13	0.12	0.37	0.22
CCREM/BC Receiving Water Criteria	0.8	0.8	0.8	0.8	0.8	0.8	0.8	0.8
Alaskan Most Stringent*	0.38	0.38	0.38	0.38	0.38	0.38	0.38	0.38
LEAD:								
Existing Border Concentrations	0.125	0.14	0.57	0.12	0.8	1.34	2.6	2
Predicted Border with Predicted Mine Discharges	0.10	0.14	0.56	0.12	0.7	1.3	2.6	2.0
Predicted Border with Max . Pot. Mine Discharges	0.13	0.14	0.57	0.12	0.9	1.3	2.6	2.0
CCREM/BC Receiving Water Criteria	2	2	2	2	2	2	2	2
Alaskan Most Stringent*	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
ARSENIC:								
Existing Border Concentrations	<1	<1	<1	<1	<1	1.7	1.3	1.8
Predicted Border with Predicted Mine Discharges	1.0	0.6	0.8	0.6	0.9	1.7	1.3	1.8
Predicted Border with Max . Pot. Mine Discharges	1.6	0.6	0.8	0.6	1.6	1.8	1.3	1.9
CCREM/BC Receiving Water Criteria	50	50	50	50	50	50	50	50
Alaskan Most Stringent*	0.18	0.18	0.18	0.18	0.18	0.18	0.18	0.18
SULPHATE:	(mg/L)							
Existing Border Concentrations	18.3	18.7	7.3	13.6				
Predicted Border with Predicted Mine Discharges	19.9	19.0	7.4	13.9				
Predicted Border with Max . Pot. Mine Discharges	n/a	n/a	n/a	n/a				

* from US EPA, Nov. 6, 1997 letter to EAO, assuming hardness of 25 mg/L

	(mg/L $CaCO_3$)				(mg/L $CaCO_3$)			
HARDNESS:								
Existing Border Concentrations	102	96	42	63	102	96	42	63

Juneau & Douglas
are
Non-Subsistence Use Areas
Here is the State Law

5 AAC 99.016 Activities permitted in a Non-Subsistence Area

(a) A nonsubsistence area is an area or community where dependence upon subsistence is not a principal characteristic of the economy, culture, and way of life of the area of the community. In a nonsubsistence area, the following activities will be permitted by the appropriate board by regulation:

(1) general hunting, including drawing and registration permit hunts;

(2) personal use, sport, guided sport, commercial fishing, and other fishing authorized by permit;

(b) Subsistence hunting and fishing regulations will not be adopted for these areas and the subsistence priority does not apply. (Eff. 5/15/93. Register 126)

Authority AS 16.05.251 AS 16.05.258
AS 16.06.255

United States Department of the Interior

U.S. GEOLOGICAL SURVEY
Water Resources Division
4230 University Drive, Suite 201
Anchorage, Alaska 99508-4664

September 18, 1998

RECEIVED
SEP 25 1998
By________

Mr. Douglas E. Dobyns
Environmental Planner
Douglas Indian Association
1112 Third Street, Suite 200
Douglas, Alaska 99824

Dear Mr. Dobyns:

Enclosed is a copy of the proposal "*Water Quality Monitoring of the Taku River in Southeast Alaska*," prepared by Bruce Bigelow and Bronwen Wang of my staff. The proposal is for a five-year water-quality monitoring program of the Taku River at the U.S.Geological Survey (USGS) gaging station. A report interpreting the results will be published the year after the final samples are collected.

The USGS has a cooperative-studies program that permits USGS to pay up to half the costs of studies such as this one. Unfortunately our cooperative funds are already committed for both FY 1998 and FY 1999. In order to reduce the costs to you, we have calculated the budget based on the assumption that the intern would be paid by Douglas Indian Association. This avoids our overhead charges on the salary. The intern will be asked to sign a "volunteer agreement" with USGS. This agreement ensures that he or she is covered by workmen's compensation and the Tort Claims Act. If the agreement is finalized, I will try to commit cooperative funds in future years as the funds become available.

Please feel free to comment on any aspect of the proposal. When we reach mutual agreement on all aspects, I will send you a Joint Funding Agreement for your signature.

If you have any questions, please call Bruce Bigelow in Juneau at 586-7287 or Bronwen Wang in Anchorage at 907-786-7110.

Sincerely,

Gordon L. Nelson
District Chief

Enclosure

Water-Quality Monitoring of the Taku River in Southeast Alaska

Background:
The reopening of the Tulsequah Chief Mine on the Tulsequah River has been permitted by the Canadian government and the operations are anticipated to begin within the next two years. Production of copper, lead, zinc, and gold concentrates from the mined ore is projected to occur on site. The possible reopening of this mine has raised concerns about potential effects of mine drainage on the water quality of the Tulsequah and Taku Rivers. The Tulsequah enters the Taku River about 17 miles upstream from the U.S.-Canada border. The Taku River maintains both a commercially viable salmon fishery important to Alaska and Canada and an active sport fishery. The river is a major tourist destination for southeast Alaska, and is important to the subsistence and traditional lifestyle of the people of the Taku River. Glacial outburst floods occur annually along the Tulsequah River and the flooding is measurable on the Taku River.

Problem:
Many studies have described the potential effects of mining on water quality. These effects include increased sedimentation, increased trace element loading, and acid mine drainage, which occurs when acid-generating minerals–such as sulfides–are present. Such effects degrade the quality of the water receiving mine drainage. Acid mine drainage, increased trace element and sediment loading, and the role of the Tulsequah's outburst floods on sediment transport to the Taku are all concerns associated with the re-opening of the Tulsequah Chief Mine.

Currently, the copper concentrations in the river at the U.S.-Canada border is near or exceeds the Alaskan water-quality standard (assuming a hardness of 25 mg/L $CaCO_3$) and lead exceeded the standard during the July-to-August period (Mehling Environmental Management Inc., 1998). Based on the projected discharge and concentrations from the proposed mine water treatment plant, Mehling Environmental Management Inc. concluded that the concentrations of copper, lead, zinc, cadmium, and arsenic would not increase due to mine operations, though sulfate concentrations might. Nevertheless, because of the current proximity between the standards and water quality, monitoring water quality before and during the mining operations would be prudent.

Outburst floods from Tulsequah Lake occur annually between early June and late August, possibly doubling the discharge on the Taku River over two or three days. During the floods, a temperature difference of 4 degrees Celsius has been measured between the left and right banks at the U.S. Geological Survey (USGS) gaging station, located about 20 miles downstream from the confluence of the Taku and Tulsequah Rivers. This temperature difference indicates that water resulting from the outburst flood remains a discrete parcel of water and does not mix throughout the river for quite some distance. The effect of the outburst flooding on the water chemistry and sediment concentration will depend on the differences between the floodwater and the existing stream water. The effect of mining on the water and sediment quality during flooding will depend on the extent of interaction between floodwaters and the mining operations. Because of the lack of mixing, solute concentrations and loading could be overestimated or underestimated based on a point sample. Careful sampling during this period is necessary to determine what, if any, effect the outburst floods have on water quality.

Objectives:
The objective of this sampling program is: (1) to determine the water quality of the Taku River prior to the re-opening and operation of the Tulsequah Chief Mine, (2) to determine the effect of annual outburst flooding on the transport of suspended sediments in the Taku River, and (3) to evaluate changes in the water quality, if any, following the re-opening of the Tulsequah Chief Mine.

Approach:
Water-quality samples will be collected at the current USGS gaging station. This station is located about 20 miles downstream from the confluence of the Taku and Tulsequah Rivers and about 3 miles from the U.S.-Canada border. Because of seasonal variability in river chemistry and streamflow, samples will be taken to cover the range of hydrologic conditions. Monthly samples will be taken during from May to October, the open-water season when the greatest discharge and sediment transport occurs. A late-winter sample will be collected prior to break-up for low-flow conditions. Three additional samples will be taken during the breakout flood. Evaluation of interannual variability may be limited because of the short time frame before the mine is scheduled to open. Samples will be collected for five years; this time span should cover the period prior to the opening, and the initial opening and operation of Tulsequah Chief Mine.

Samples will be collected and processed according to standard USGS protocols. Stream discharge will be measured and used to calculate five equal discharge increments (EDI). Vertically integrated suspended- sediment samples will be taken at the five EDI points. Each vertical will be analyzed for the suspended-sediment concentration. The total suspended-sediment load will be calculated from the discharge and the concentration. Water samples for chemical analysis will be depth- and width-integrated composite samples. These samples will be analyzed for concentrations of major anions and cations, total and dissolved trace elements, suspended sediments, total and dissolved organic carbon, and nutrients (table 1).

Table 1. *Sample analysis*

Dissolved major cations and anions	Calcium, magnesium, sodium, potassium, sulfate, carbonate, chloride, fluoride, chloride, silica
Total trace elements	Lead, copper, silver, zinc, chromium, cadmium, selenium, arsenic, aluminum, iron, manganese, nickel, barium, mercury
Dissolved trace elements	Lead, copper, silver, zinc, chromium, cadmium, selenium, arsenic, aluminum, iron, manganese, nickel, barium, mercury
Nutrients	Ammonia, phosphorus, ortho-phosphate, nitrate
Organic carbon	Total organic carbon, dissolved organic carbon
On-site physical and chemical measurements	Specific conductance, pH, dissolved oxygen, water and air temperature, alkalinity, hardness
Suspended sediment	

The USGS laboratory in Arvada, CO or their contract laboratories will analyze samples. Cross-sectional physical and chemical measurements of water quality made on-site will be specific conductance, pH, dissolved oxygen, water and air temperature, alkalinity, and hardness (table 1). The resulting analyses will be stored in the USGS water-quality and hydrologic data bases and published in the annual data report. Following the fifth year, an interpretive report will be produced detailing the results and implications of the data collection to date.

In addition to the environmental samples, quality-control samples will be collected. These will include equipment and field blanks, and duplicate samples.

During the course of the program, a tribal intern will be trained in a variety of activities related to water-quality sampling. These include sampling techniques, quality assurance and quality control, data-base storage, and data publication. In addition, the intern will be introduced to several surface-water hydrologic techniques, such as discharge measurements and data-reduction techniques. The training will be accomplished through either a student or part-time appointment (pending position availability) or the Volunteer Program. The intern would also be an author on the interpretive report.

Budget:

Item	**Year**					
	One	**Two**	**Three**	**Four**	**Five**	**Six**
Hydrologist/ Hydrologic Technician	5,000	5,200	5,400	5,600	9,800	4,500
Tribal Intern	<salary paid by D.I.A.>					
Laboratory Cost	20,600	21,00	21,500	21,900	22,300	
Equipment/ Supplies/Publication	7,700	2,200	2,200	2,200	2,300	
Travel	3,100	3,200	3,300	3,400	3,500	
Shipping	1,100	1,150	1,200	1,200	1,300	
Publication						10,500
Total	**37,500**	**32,750**	**33,600**	**34,300**	**39,200**	**15,000**

Reference Cited:

Mehling Environmental Management, Inc.,1998, Tulsequah Chief Project–Cumulative water quality effects assessment: Vancouver, B.C., Canada, MEM Project 009-002-02 Report, 21 p.

Mr. Bill Riley
Water/Mining Coordinator
Environmental Protection Agency
1200 6th Avenue
Seattle, WA
USA 98101

Mehling Environmental Management Inc.

3826 Balaclava Street
Vancouver, B.C.
V6L 2S8
phone: (604) 731-4150
fax: (604) 733-4255

MEM Project # 009-002-01

Re: Tulsequah Chief Project
Cumulative Water Quality Effects Assessment

At the request of Norm Ringstad of the BC Environmental Assessment Office, I am forwarding to you a copy of the subject report for your information.

Yours truly,

Per: P. Mehling
Mehling Environmental Management Inc.

TABLES

FIGURES

APPENDIX A: Existing and Predicted Loadings and Concentrations

Water quality sampling data at each selected site were used to determine the average, as well as the range (maximum and minimum) of water quality concentrations for each of the four seasons for the parameters of interest. The parameters identified were:

- Copper;
- Zinc;
- Cadmium;
- Lead; and,
- Arsenic.

A value of one half the detection limit was used in calculating the averages when measured concentrations were below analytical detection limits. Sulphate was also examined, since sulphate is generally considered to be less susceptible to chemical transformations and precipitation than metals, and might provide a check on the accuracy of mass balance model.

Flows for each water quality sampling station were estimated for each of the four seasons from available data. Where flow data were not available, flows were prorated using relative catchment areas and estimated monthly mean flows generated from regional hydrology assessments from existing studies at the Tulsequah Chief and Polaris-Taku sites (Redfern, 1997a, 1997b; Gartner Lee, 1996, 1997).

3.0 Data Sites

Sites used in this assessment are shown on Figure 1. The sites include:

- Upstream Taku River (site 21);
- Upstream Tulsequah River (site 10);
- Big Bull Discharge (site 19);
- Canarc Exploration Mine Water Discharge (site MW-2)
- Whitewater Creek Tailings (site SW3)
- Tulsequah Chief Adit Discharges (site 13 and 16);
- Proposed Tailings Pond;
- Proposed Effluent Treatment Plant (ETP); and,
- Taku River at Canada/US Border (site 22).

Descriptions of each site, and sources for water quality and flow data, are given below. Calculated averages and flow estimates used in the analyses are provided in Appendix A.

3.1 Upstream Background Sites

A summary of estimated seasonal loads for each parameter from each site is shown on Tables A1 through A6 in Appendix A under the title 'Summary of Upstream Background

Flows from the historic Big Bull adit were estimated at < 2 L/sec (pers. comm. Ian Sharpe) in summer (August). No other flow estimates were available. Flows were not prorated for this assessment as the discharge was described as being primarily from the adit, an underground source.

3.2.2 Canarc Exploration Mine Water Discharge

Data characterizing the mine water discharged during 1997 from exploration activities in existing underground workings were provided by Canarc Resources's consultant Gartner-Lee Limited. Actual monitored discharge quality at site MW-2 was used to develop seasonal water quality values. Since data was not available for the July/August and September through December period, the May-June concentrations were assumed for those periods in this assessment. The average daily discharge calculated from the total discharge volume from February 23 to July 10, 1997 was 36.6 L/sec. Spot measured flows were higher, ranging from 37.9 L/sec to 53.0 L/sec. For this assessment, it was assumed that a discharge of 36.6 L/sec would continue through all four seasonal periods.

It has also been assumed that the estimated loadings from current discharges would continue at the same rate in future years, even though predictions anticipate a reduction to 15 L/sec maintenance flow once initial dewatering of the workings were completed (Gartner Lee, 1996).

3.2.3 Whitewater Creek Tailings

The influence from the residual tailings along Whitewater Creek was included in this assessment by using water quality data for Canarc's Site SW-3, located on Whitewater Creek downstream of the mine site. No water quality data was available for the low flow months (January/February), therefore the concentration values for September through December months were conservatively assumed for January/February, since these tended to be the highest concentrations in the three monitored seasonal periods.

Whitewater Creek flows of 510 L/s measured on August 9 1996 (Gartner-Lee, 1997) were assumed to represent the mean flow for the summer seasonal period. This value was used in conjunction with the estimated Tulsequah River mean monthly flow estimates (Table 2.5-5, Volume III, Redfern, 1997a) to prorate flows for other seasonal periods. It was estimated that these seasonal flow values would translate to a catchment area of approximately 3 km^2, although the actual size of the catchment basin was not verified.

It has been assumed that the estimated loadings from the Whitewater Creek tailings would continue at the same rates in future years.

tailings pond (Redfern, 1997b). Redfern also provided additional information on treated effluent quality should 100% mine water or 100% tailings supernatant be directed to the treatment plant (Table 4, Redfern, 1997b). However, Redfern considered it unlikely that all effluent to the treatment plant would be entirely tailing supernatant or mine water, since mine water is a steady year round source, while tailings supernatant volumes will vary somewhat with precipitation. Therefore, the predicted effluent quality for a 60% tailings supernatant/40% mine water blend at pH 9.0 as reported in Table 5.6-2, Volume IV (Redfern, 1997a) has been selected as the effluent discharge quality for this assessment. The predicted effluent quality included values for dissolved metals, but not for total metals or sulphate. For this assessment, total metals were assumed to be equal to predicted concentrations for dissolved metals, and a sulphate concentration of 600 mg/L was selected.

The effluent treatment plant was sized to accommodate the combined volume of all mine water, temporary PAG waste pile runoff, pyrite storage pond excess water and water collected from the tailings impoundment which is not reused as process water. (Page 7, Redfern 1997b). An effluent discharge rate to the Tulsequah River of 168 m^3/hour (0.0467 m^3/sec) has been estimated (Redfern, 1997b), and used in this assessment. A water diffuser is proposed, with a provision for an additional discharge point in the next water channel over the gravel plain as necessary during low flow periods in the river to ensure mixing with the main channel flow.

3.4 Maximum Potential Discharge Loads

The Ministry of Environment, Parks and Land typically sets permit criteria at maximum concentrations and flows that must not be exceeded. This practice is designed to address inevitable short term events where flows and/or concentrations in effluent discharges are higher than the average values anticipated on a day to day basis. Although it is considered unlikely that both flows and concentrations would peak at all sites simultaneously, an additional scenario has been assessed which assumes both flow and concentrations are concurrently higher than predicted and/or measured average values for both the Tulsequah Effluent Treatment Plant and the Canarc mine water discharge.

The selection of the maximum flows and concentrations used in this assessment are outlined in sections 3.4.1 and 3.4.2 for the Tulsequah Effluent Treatment Plant discharge and the mine water discharge from the Canarc exploration site. A summary of the loadings from these estimated maximum conditions, combined with other existing discharges (Whitewater Tailings and Big Bull) and potential seepage from the Tulsequah tailings impoundment are provided in tables in Appendix A titled 'Summary of Maximum Potential Mine Discharges'.

the treated effluent. The dissolved and total arsenic concentrations selected for assessment are 17 and 33 times higher than the predicted dissolved arsenic treated effluent concentration of 3.0 ug/L. Therefore, it is considered unlikely that the effluent discharge would discharge at these selected peak concentrations for lead and arsenic other than for extremely short periods.

Loadings were calculated using the maximum flow capacity of the proposed treatment plant of 218 m^3/hr (0.0606 m^3/sec). This high flow rate is unlikely to be utilized unless period of unusually high precipitation necessitate greater flows of tailings supernatant being directed to the treatment plant. It is anticipated that such occurrences would be concurrently reflected in higher flows in the Tulsequah River, resulting in greater dilution that predicted by this assessment.

3.4.2 Canarc Mine Water Discharge

Approval AE-14707 was issued by the Ministry of Environment, Lands and Parks for dewatering of the historic underground mine workings at Canarc's property at the Polaris-Taku site.

The approval required that the characteristics of the discharge be within 6.5 and 10.0 pH units, and equivalent to or better than;

- 1.0 mg/L dissolved arsenic
- 0.05 mg/L dissolved copper, and,
- 0.2 mg/L dissolved zinc.

No maximum allowable values for total metals were included in the Approval. However, the Approval also required that, at 100% concentration, the effluent would cause no more than 50% mortality in a 96 hr LC_{50} rainbow trout bioassay test. Actual flow volumes and discharge water quality were well within these maximum allowable values.

For this assessment, the maximum values identified in the Approval have been used, although a request for an ongoing discharge would be subjected to review by MELP, and might result in more stringent values. For dissolved metals not identified in the Approval, peak values were selected on review of:

- Effluent concentration ranges for dissolved metals identified by British Columbia Pollution Control Objectives (Pollution Control Board, 1979);
- Maximum allowable mean monthly concentrations, and maximum allowable grab sample concentrations, for total metals specified by the federal Metal Mining Liquid Effluent Regulations (MMLER);
- The maximum concentrations recorded for the existing discharge; and,
- An arbitrary value set as 10 times the average effluent concentrations.

3.5 Taku River at Canada/US Border

Existing water quality data for the border station was obtained from Station W 22, Volume III Appendix B.2-5b, (Redfern, 1997a). A transect water quality study indicated that the grab samples collected at the border station were reasonably representative of the water quality across the width of the Taku River at that site (Redfern, 1997a). Estimated flows were obtained from Table 2.5-7, Volume III (Redfern, 1997a), with the monthly mean flows combined and averaged for each seasonal period.

4.0 Results and Discussion

The estimated concentrations and flow for each of the four seasonal periods, and each of the selected parameters for each site are shown in Appendix A. Loadings (concentration x flow) have been calculated for each season and site, and are also provided in Appendix A in order to evaluate how the estimated loadings are reflected in loadings at the border station, and to examine the relative influence of the various sources of each parameter. These loadings have been summarized for the following scenarios:

- A sum of upstream, or background loadings from the upstream Taku and Tulsequah Rivers;
- A sum of the existing loadings from the various mine sites, including the Big Bull Mine, Canarc's exploration discharge, Whitewater Creek and the existing flows from Tulsequah Chief Adits 5200 and 5400;
- A sum of the potential loadings from the proposed Tulsequah Chief tailings impoundment and predicted loadings from the proposed effluent treatment plant, in combination with the existing discharges from the Big Bull, Canarc's exploration discharge, and Whitewater Creek; and,
- A sum of maximum potential loadings should the Tulsequah Chief effluent treatment plant and Canarc's exploration discharge continuously discharging at maximum selected levels of both flow and concentrations, combined with the potential seepage loadings from the proposed Tulsequah Chief tailings impoundment, and the existing discharges from the Big Bull and Whitewater Creek sites.

Because ecosystem impacts are related to concentrations rather than loadings, the concentrations at the border potentially arising from these scenarios have also been calculated. These results are discussed below.

4.1 Loadings

4.1.1 Conservation of Mass

The existing dissolved metals loadings estimated at the background site W 21 on the upstream Taku River often exceed existing loadings at the Canada-US border station for the selected seasonal periods. Thus the data does not demonstrate the ideal of water discharge from Canarc's exploration project. The discharged load of total and dissolved arsenic exceeds background loadings measured at the Tulsequah River upstream station during the January/February low flow periods, and is approximately equivalent to measured Tulsequah River loads during the March through June, and the September through December periods. During high flow, the background loads in the Tulsequah River are 5 to 10 times higher than the mine water discharge loads of dissolved and total arsenic.

4.1.3 Contributions from Predicted Loadings

The sum of predicted loadings from the proposed Tulsequah Chief mine, in combination with continued discharges from other mine sites in the area, is substantially less than the existing loadings from mine site discharges for all examined parameters, with the exception of sulphate. Ratios of existing discharge loads to predicted and continued existing mine discharge loads are shown on the tables in Appendix A and summarized in Table 3 below.

Table 3: Ratios between the Sum of Existing Mine Discharge Loads and the Sum of Predicted and Continued Existing Mine Discharge Loads

	Jan/Feb	Mar - June	July/Aug	Sept-Dec.
D. Cu	22	39	35	19
T. Cu	24	37	31	17
D. Zn	20	33	16	14
T. Zn	23	37	17	15
D. Cd	19	28	16	16
T. Cd	19	28	13	16
D. Pb	4.6	4.1	3.4	3.3
T. Pb	6.6	4.8	3.8	3.6
D. As	1.1	1.0	1.0	1.0
T. As	1.3	1.2	1.2	1.2
SO_4	0.09	0.13	0.17	0.14

Note: A ratio of 22 indicates that the existing load of D.Cu is 22 x greater than the predicted load. A ratio of 0.09 for SO^4 indicates that the existing load is 11.1 x less than the predicted load.

Predicted sulphate loads appear to be greater than the exisintg loads. This is primarily short periods of time are partially due to overly conservative selection of assessment parameters, the current low discharges of arsenic from the Tulsequah Chief adits, and the current low discharges of lead from the Canarc mine site. Specifically:

- The lead and arsenic concentrations selected for assessment for the maximum potential discharges from the proposed Tulsequah Chief mine have been chosen to be overly conservative, in order to select values that provide reasonable detection limits for an effluent quality discharge. Selected values are more stringent than the MMLER and the lower range identified by the Pollution Control Objectives.
  - The dissolved and total lead concentrations of 30 and 100 ug/L selected for assessment are 40 and 120 times greater than predicted concentrations from the treatment plant of 0.74 ug/L.
  - The dissolved and total arsenic concentrations of 50 and 100 ug/L selected for assessment are 17 and 33 times greater than predicted concentrations from the treatment plant of 3.0 ug/L.

It is considered unlikely that the effluent would discharge at these selected concentrations, particularly for prolonged periods.

- The lead concentrations selected for assessment of the maximum potential discharge from the Canarc sitehave also been chosen to be overly conservative, in order to select values that provide reasonable detection limits for an effluent quality discharge. Selected values are more stringent than the MMLER and the lower range identified by the Pollution Control Objectives, yet 2 to 10 times higher than previously measured dissolved and total lead values, and 15 and 50 times higher than the average monitored dissolved and total lead values. It is considered unlikely that the effluent would discharge at the selected concentrations for lead, other than for extremely short periods.

4.2 Concentrations

4.2.1 Existing Border Concentrations

Existing concentrations measured at the Canada-US border station are a result of existing natural background loads from the Taku and Tulsequah River, the existing continuous discharges from the Big Bull Mine, Tulsequah Chief adits, and Whitewater Creek tailings, as well as the 1997 mine water discharges from Canarc's exploration program.

Existing measured concentrations at the border are shown on Table 5 for each parameter in comparison to CCREM and B.C. water quality criteria (Nagpal, 1995), calculated using average measured hardness during each seasonal period. Average seasonal hardness values for the Taku River are also shown, ranging from 102 mg/L $CaCO_3$ during the January/ February low flow period, to 42 mg/L $CaCO_3$ during July/August high flow period. Existing concentrations are also shown graphically on

Figures 2 (copper and zinc) and 3 (cadmium and lead).

The 'most stringent criteria' identified in a Nov. 6, 1997 from W.M. Riley, US Environmental Protection Agency to N. Ringstad, Environmental Assessment Office, are also shown for comparison. These most stringent criteria are identified as not necessarily being the same as the Alaska Water Quality Standards, and were all calculated assuming a hardness in the Taku River of 25 mg/L $CaCO_3$.

Existing dissolved metal border water quality averaged for the four seasonal periods currently exceeds CCREM and B.C. receiving water criteria for total copper in all seasons except in the September through December seasonal period. Existing total metal border water quality currently exceeds CCREM receiving water criteria for total zinc in the September through December season, and total lead in the July/August and Sept.-Dec. seasonal periods. CCREM receiving water criteria are met for all other parameters during all seasonal periods.

Comparison to the USEPA's quoted most stringent criteria indicates that the copper and zinc criteria are less stringent than CCREM, but are still exceeded at the border by dissolved copper values in the January/February period, and total copper concentrations in all seasons. The zinc criteria is met for all seasonal periods. The quoted cadmium criteria of 0.38 ug/L is not exceeded, but the lead criteria of 0.55 ug/L is currently exceeded by dissolved lead concentrations at the border during July/August, and by total lead concentrations during all seasonal periods. The arsenic criteria of 0.18 ug/L is less than the sample detection limit of 1 ug/L, and may be exceeded during all seasonal periods.

4.2.2 Influence of Existing Discharges on Border Water Quality

The influence of existing discharges on the border water quality was examined by looking at the ratio between the existing loadings at the border station relative to the sum of the measured loadings from background and existing mine site discharges (see Table 6). This method does not explain or justify the inability to demonstrate conservation of mass, but assumes that the ratio between upstream loading inputs and the resulting downstream loads at the border represents a valid relationship for a particular parameter and a particular seasonal period.

The results do not indicate any clear trends. However, July/August appears to consistently contain the lowest or near lowest ratios, indicating a fairly close conservation of mass. This seems reasonable given the higher flows and less potential for settling during those periods. The highest ratios for dissolved metals occur either during the low flow January/February, or the September through December period,

- Dissolved and total copper concentrations projected at the border improve from 1 to 29 % over existing border concentrations, but continue to exceed CCREM/BC water quality criteria for most seasonal periods.

- Dissolved and total zinc concentrations also improve from 1 to 35% over existing concentrations. Projected improvements will bring total and dissolved zinc under CCREM/BC water quality criteria for all periods, including the January/February low flow period which currently exceeds CCREM/BC water quality criteria for total zinc.

- Dissolved and total cadmium concentrations are projected to improve from 1 to 38%, and continue to meet CCREM/BC water quality criteria.

- Dissolved and total lead concentrations are projected to remain similar to existing levels or improve up to 18%, and continue to meet CCREM/BC water quality criteria with the exception of total lead for the July/August high flow period (2.6 ug/L as compared to CCREM/BC at 2 ug/L).

- Dissolved and total arsenic concentrations essentially remain the same, since both the existing Tulsequah Chief adit discharge quality and the predicted Tulsequah Chief treated effluent and seepage discharge quality contain low levels of arsenic.

4.2.4 Influence of Maximum Potential Mine Discharges on Border Water Quality

Border water quality has also been predicted for upstream loads consisting of loadings from upstream background stations, peak loads from the Tulsequah Chief treatment plant and Canarc mine water assuming maximum potential flows and selected maximum concentrations, in combination with existing loads estimated for the Whitewater Creek tailings and Big Bull Mine discharge. Predicted concentrations for **potential maximum short term peak loads** at the border are shown on Table 5, and graphically on Figures 2 and 3.

The results for the maximum potential cumulative peak discharges indicate:

- Concentrations at the border would experience the greatest change during the low flow January/February seasonal period.

- Dissolved and total copper concentrations projected at the border would improve from 1 to 28 % over existing border concentrations, but would continue to exceed CCREM/BC water quality criteria for most seasonal periods.

5.0 Conclusions

The simple mass balance assessment conducted on the Taku/Tulsequah watershed indicated:

- Loadings from cumulative predicted discharges from all identified sites would be substantially less than current cumulative effluent discharges, with the possible exception of sulphate. Table 2 shows the estimated ratio by which the existing cumulative mine site discharges would be reduced in each seasonal period.

- Loadings from the cumulative sum of maximum potential peak concentrations and flows from the Tulsequah Chief treatment plant and Canarc exploration program, combined with predicted tailings pond seepage and other discharges from Big Bull Mine and Whitewater Creek tailings, are estimated to be less than the current cumulative effluent discharges, with the possible exception of arsenic and lead.

- Under the scenario of short term peak loads, projected concentrations for lead and arsenic at the border would not change significantly from currently measured concentrations and would not change with respect existing concentrations in terms of their ability to meet CCREM/BC water quality criteria (see Figure 3).

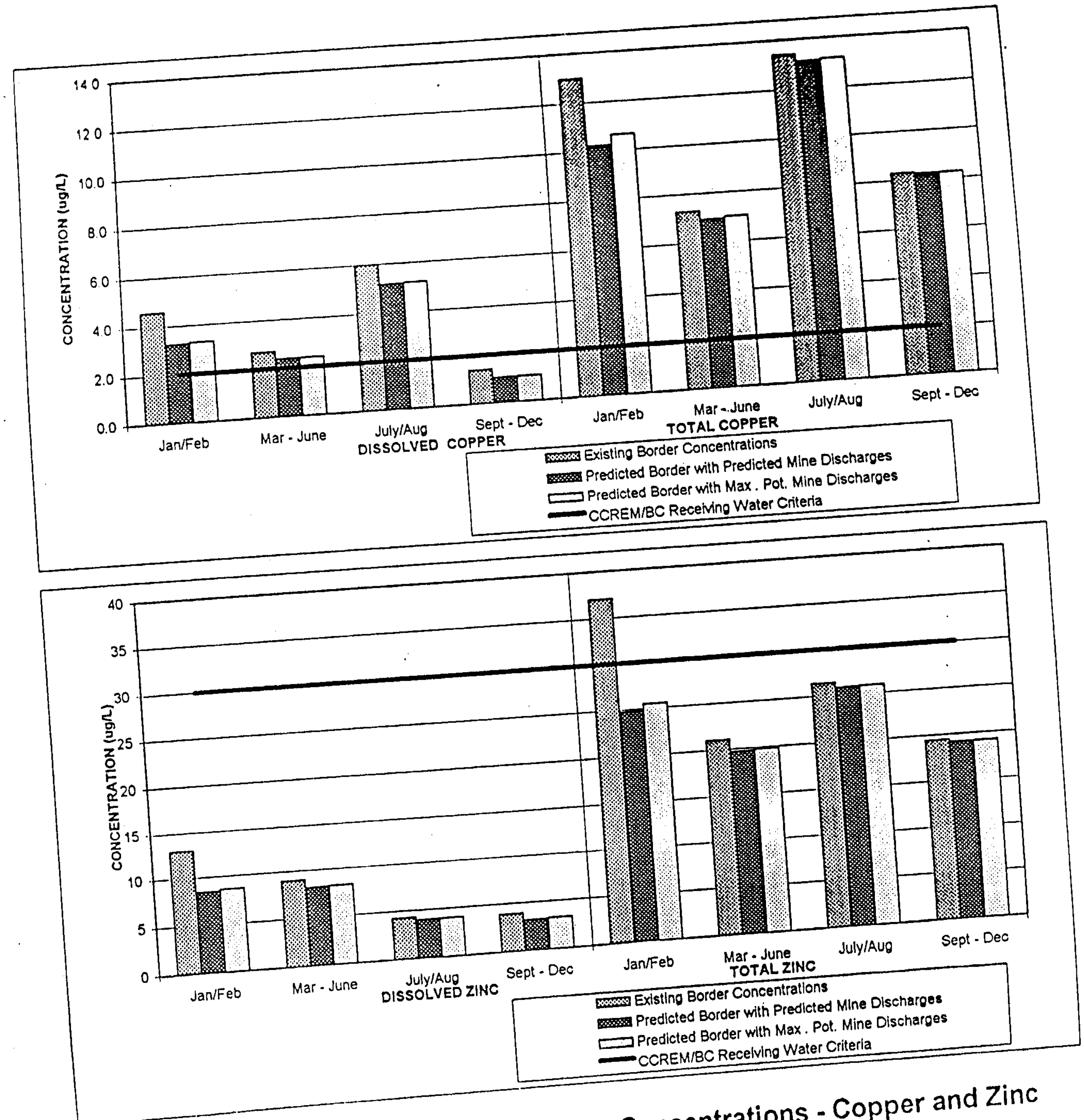
- Predicted concentrations for total and dissolved metals at the border as a result of proposed Tulsequah Chief Mine and other cumulative discharges in the watershed are estimated to improve 1 to 38 % over existing levels, with the largest improvements occurring during the January/February low flow period (see Figures 2 and 3).

- Ian Sharpe of MELP has indicated that this type of model has potential utility as a long term tool to evaluate potential impacts on border water quality from effluent discharges in the Tulsequah and Taku River watersheds. Should this semi-quantitative model be considered for this purpose, further refinement and validation would be required.

Mehling Environmental Management Inc.

P. Mehling

per:
Peri Mehling, P. Eng



Predicted Border Concentrations - Copper and Zinc

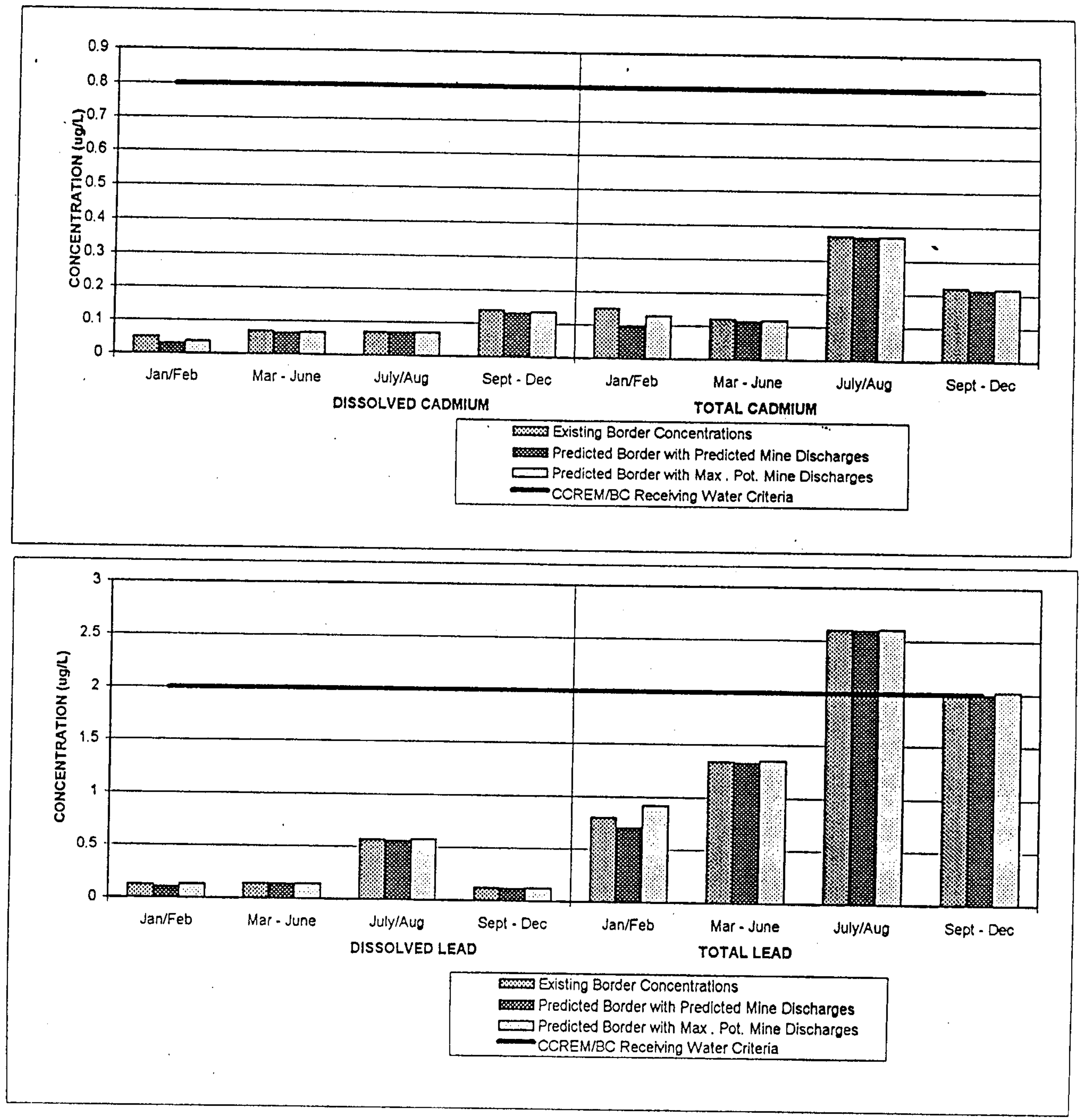


Figure 3 Existing and Predicted Border Concentrations - Cadmium and Lead

Douglas Indian Association
Tribal Government

Box 240541 Douglas, Alaska 99824

RESOLUTION 98-04-03

Title: Support of Yanyeidi Communication Network

WHEREAS, the Douglas Indian Association is a federally recognized Tribal governing body for the community of Douglas, Alaska, organized pursuant to the Indian Reorganization Act of June 18, 1934 and as amended by the Alaska Act of May 1, 1936, and

WHEREAS, the Douglas Indian Association wants to continue to communicate with the Yanyeidi neighbors in British Columbia, and whereas the Douglas Indian Association encourages dialogue with all clans affiliated with the Douglas Indian Association, and

NOW THEREFORE BE IT RESOLVED that the Douglas Indian Association encourage dialogue on mutual issues of concern between the Yanyeidi clan, and

NOW THEREFORE BE IT RESOLVED that the Douglas Indian Association recognizes all clan affiliations of the membership; and continues to offer encouragement to enhance communication of tribal people.

CERTIFICATION

This resolution was duly considered and adopted by the Douglas Indian Association Tribal Council called and convened this 1st day of April, 1998 by a vote of 7 Yeas, 0 Nays, 0 Abstentions and 2 absent.

Frank [illegible] 4-1-98
President Date

Attest:

Madeline Gordon 4-1-98
Secretary Date

Phone (907) 364-2916 1112 Third Street, Suite 200 Fax (907) 364-2917

Douglas Indian Association
Tribal Government

Box 240541 Douglas, Alaska 99824

Resolution 98 - 04 - 02

Title: Request for International Joint Commission Negotiation

WHEREAS, the Douglas Indian Association is a Federally recognized Tribe in accordance with, and by authority of P.L. 93-638 on June 13, 1934, and as amended on June 15, 1935, and

WHEREAS, the issues surrounding the proposed Redfern Mine and Road in B.C. are complicated by the position of the international boundary, and

WHEREAS, the Governor of the State of Alaska has asked for a negotiation with the assistance of the International Joint Commission in settling these issues, and

WHEREAS, the area considered for the mine site, and impacted areas immediately downstream, are within the Traditional Territory of the Douglas Indian Association, and

WHEREAS, it is the trust responsibility of the United States to see that the resources and homelands of the people of Douglas Indian Association are safeguarded,

NOW THEREFORE BE IT RESOLVED, that the Douglas Indian Association request that the Secretary of Interior notify the Secretary of State for the United States that it is in the interests of Alaska, the United States, and the IRA Tribal Government of the Douglas Indian Association to have the hearing of these issues surrounding the Redfern Mine held by the International Joint Commission under the terms of the Boundary Waters Treaty of 1909, and

BE IT FURTHER RESOLVED, that letters also be sent immediately to the Juneau Area Office of the Bureau of Indian Affairs, the Governor of Alaska, the U.S. Council on Environmental Quality, and the U.S. Environmental Protection Agency, to state the intent of this Resolution.

Adopted this day of April 1, 1998, by the Council by a vote of 7 yeas, 0 nays, 0 abstentions, and 2 absences.

Frank Mayworth 4-7-98
President Date

Attest:

Madeline Gordon 4-2-98
Secretary Date

Phone (907) 364-2916 1112 Third Street, Suite 200 Fax (907) 364-2917

Douglas Indian Association
Tribal Government

Box 240541 Douglas, Alaska 99824

RESOLUTION 98-04-03

Title: Support of Yanyeidi Communication Network

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[signature] 4-1-98
President Date

Attest:

Madeline Gordon 4-1-98
Secretary Date

Phone (907) 364-2916 1112 Third Street, Suite 200 Fax (907) 364-2917

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Adopted this day of April 1, 1998, by the Council by a vote of 7 yeas, 0 nays, 0 abstentions, and 2 absences.

Frank Mayasth 4-2-98
President Date

Attest:

Madeline Gordon 4-2-98
Secretary Date

Phone (907) 364-2916 1112 Third Street, Suite 200 Fax (907) 364-2917

Douglas Indian Association
Tribal Government

Box 240541 Douglas, Alaska 99824

RESOLUTION 98-04-03

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[illegible] 4-1-98
President Date

Attest:

Madeline Gordon 4-1-98
Secretary Date

Phone (907) 364-2916 1112 Third Street, Suite 200 Fax (907) 364-2917

Douglas Indian Association
Tribal Government

Box 240541 Douglas, Alaska 99824

January 14, 1999

Mr. Strobe Talbott
Deputy Secretary of State
U.S. Department of State
2201 C Street, NW, Room 7220
Washington, DC 20520-7512

Dear Mr. Talbott:

The Douglas Indian Association has a continuing concern over the development of the Tulsequah Chief mine in British Columbia, and has passed several Resolutions to express this concern. The British Columbia government is proceeding with development permits to establish road access in spite of protests from Alaska over the potential impacts to the salmon stocks in the Taku River.

The Taku River is the traditional territory of the Taku Kwaan, which makes up the principle Tribal enrollment of the Douglas Indian Association. The Taku River is both the source of the Tribal culture and the center of the subsistence economy. It is also the main producer for salmon in the local commercial fisheries, and has a high potential for the growing tourism interest in the Juneau area.

The requests from the U.S. State Department to have a hearing of these issues under the International Joint Commission reflect the positions of our Tribal Council, and we believe to be necessary for the U.S. to fulfill their trust responsibilities to this Tribe and to our people. These requests appear to rest firmly upon rights established in the Boundary Waters Treaty of 1909. If high levels of concern exist for the water quality and integrity of the salmon ecosystem in the Alaskan portion of the Taku River, these concerns should be addressed under an IJC review.

In the letter of January 6th, Alaska's Governor Knowles stated: "Most recently, the preparations for building a winter road, which crosses our joint watershed, are proceeding in spite of the December 4 letter from the State Department to the Canadian Embassy clearly stating the U.S. position that no action should take place on the ground until there is a mutually agreeable conclusion to ongoing discussions. To our knowledge, this is the first time in IJC history that permitting for a project has continued while the project is under review for an IJC referral."

Phone: (907) 364-2916 1112 Third Street Fax (907) 364-2917

The Douglas Indian Association is pleased that the Governor is expressing this level of concern, and that there are others in the U.S. who share in the concern for the Taku River. The Tribe here has invested staff time to develop and begin a water quality sampling program jointly with the U.S. Geological Survey and U.S. EPA. This program is scheduled for five years, to document the water quality base line conditions of the Taku River near the Canadian Border. The first samples were received by the EPA Manchester Lab in Washington State two months ago. The Tribe is also researching the salmon ecosystem conditions on the Taku River, and has begun cooperative studies with several agencies to these ends.

Our activities and concerns are being reflected by actions taken by the Taku River Tlingit First Nation in Atlin, British Columbia, who are also Taku Kwaan. We note that the First Nation is proceeding with a legal challenge to the B.C. Certification of the Redfern Mine, as the old Tulsequah Chief is now known. The Douglas Indian Association intends to participate with the Taku River Tlingit in studying the resources and impacts on the Taku River, especially the salmon resources and impacts.

We are including some of the Resolutions and correspondence that relate to this problem, and would like to be kept informed of all developments from now on.

Sincerely,

Frank Miyasato

Frank Miyasato
President

cc: Melvin Jack, TRTFN
Lee Francoeur, TRTFN
Victor Comras, Canada
Tony Knowles, Alaska
Willie Taylor, DOI
Pete Christich, EPA Headquarters
Chuck Clark, EPA Region 10
Rick Albright. EPA Alaska

TONY KNOWLES
GOVERNOR

P.O. Box 110001
Juneau, Alaska 99811-0001
(907) 465-3500
Fax (907) 465-3532

STATE OF ALASKA
OFFICE OF THE GOVERNOR
JUNEAU

January 6, 1999

Mr. Strobe Talbott
Deputy Secretary of State
U.S. Department of State
2201 C Street, NW, Room 7220
Washington, DC 20520-7512

Post-it® Fax Note 7671	Date 1/11	# of pages ▶ 3
To Doug Dobbins	From K. Howard	
Co./Dept. Douglas Ind. Assoc.	Co. DCC	
Phone #	Phone # 465-8794	
Fax # 364-3917	Fax #	

Dear Mr. ~~Talbott~~: Strobe

Thank you for the Department of State's December 4 letter to Minister Higginbotham, Embassy of Canada, reiterating the United States' concern that no prejudicial action be taken regarding development of the Tulsequah Chief mine while our bilateral discussions continue. In addition, I am writing to let you know that the State of Alaska continues to have strong concerns about the proposed Tulsequah Chief mining project in northwest British Columbia. I seek your assistance in referring this proposed project to the International Joint Commission (IJC) for further review.

The Tulsequah Chief mine is a proposed underground base/precious metals mine located 40 miles from Juneau, Alaska in the Tulsequah River valley, in northwest British Columbia, Canada. Redfern Resources Ltd., the project proponent, seeks to construct an 80-mile road through the Taku River watershed to reopen a previously closed underground mine. The project site is located about 18 miles upstream from the B.C./Alaska border. The proposed mine is located on the Tulsequah River, a tributary to the Taku River, which is a transboundary river under the International Boundary Waters Treaty Act.

The Taku River, and its near pristine watershed, is a prolific producer of all five species of Pacific salmon. These fisheries are fundamental to Southeast Alaska's subsistence, sport, and commercial fishers, and the communities in which they live. The Taku River is also a transboundary river under the Pacific Salmon Treaty with Canada, and fishers from both sides of the border have benefited from joint salmon enhancement projects. By putting salmon habitat at risk, the Tulsequah mine project also puts at risk this successful program to conserve and sustain salmon. As you know, the allocation of this important salmon fishery has already been the source of difficulties between Canada and the United States.

Alaska has reviewed all key Tulsequah Chief mine project documents and has participated in numerous project meetings over the past four years. We have, on numerous occasions, made our concerns clear; but they have largely been ignored. The most recent project meeting, held in Vancouver in mid-November, ended with an apparent acknowledgement on the part of Canada that our outstanding concerns were legitimate and deserving of attention through appropriate scientific and land use studies. In spite of this acknowledgement, outstanding concerns have not been resolved.

The state is now in an untenable position. Canada has acknowledged the need to gather basic information on key aspects of mine siting, development, and operation, yet refuses to acknowledge this new information may indeed point to potential critical flaws. Our views appear irreconcilable; and, as such, we believe the matter is suitable for referral to the IJC, as we have maintained since my letter to Secretary Albright last March.

In addition, it has come to our attention that while we participate in bilateral negotiations with Canada, the mine/road permitting process continues to move forward. British Columbia appears poised and ready to issue a special use permit that would allow road construction. We find these permitting actions distressing. Most recently, the preparations for building a winter road, which crosses our joint watershed, are proceeding in spite of the December 4 letter from the State Department to the Canadian Embassy clearly stating the U.S. position that no action should take place on the ground until there is a mutually agreeable conclusion to ongoing discussions. To our knowledge, this is the first time in IJC history that permitting for a project has continued while the project is under review for an IJC referral.

Not only are the Tulsequah Chief mine issues fully ripe for IJC review and recommendation, we are at this impasse just as the IJC is expanding its role to include major watershed review. Specifically, the U.S. and Canadian governments have recommended the IJC look at the possibility of forming binational boards for several major watersheds along the joint border, including the Taku River. We believe IJC involvement is imperative *before* the Tulsequah Chief project irrevocably changes the watershed. These irrevocable acts would offend and preclude the very purposes the two nations are trying to achieve through a watershed approach.

Mr. Strobe Talbott
January 6, 1999
Page 3

I would be happy to provide you further detail to ensure that Alaska's level of interest and concern is clear. I believe it is time for the Department of State to firmly urge Canada to work with the United States in a joint IJC referral of the Tulsequah Chief mine development. I look forward to hearing from you about this important matter.

Sincerely,

Tony Knowles
Governor

cc: Victor Comras, Director, Office of Canadian Affairs
Brooks Yeager, Deputy Secretary, Department of the Interior
Willie Taylor, Director, Office of Environmental Policy and Compliance Department of the Interior
Mary Beth West, Director, Office of Oceans and Environment Department of State
Pete Christich, Director, Office of International Affairs Environmental Protection Agency

E6

Appendix E.6. Salmon catches in the Canadian Aboriginal and sport fisheries in the Alsek River, 1976-1997.

THE 1997 DATA ARE PRELIMINARY

	Chinook			Sockeye			Coho		
Year	Aboriginal	Sport	Total	Aboriginal	Sport	Total	Aboriginal	Sport	Total
1976	150	200	350	4,000	600	4,600	0	100	100
1977	350	300	650	10,000	500	10,500	0	200	200
1978	350	300	650	8,000	500	8,500	0	200	200
1979	1,300	650	1,950	7,000	750	7,750	0	100	100
1980	150	200	350	800	600	1,400	0	200	200
1981	150	315	465	2,000	808	2,808	0	109	109
1982	400	224	624	5,000	755	5,755	0	109	109
1983	300	312	612	2,550	732	3,282	0	16	16
1984	100	475	575	2,600	289	2,889	0	20	20
1985	175	250	425	1,361	100	1,461	50	100	150
1986	102	165	267	1,914	307	2,221	0	9	9
1987	125	367	492	1,158	383	1,541	0	49	49
1988	43	249	292	1,604	322	1,926	0	192	192
1989	234	272	506	1,851	319	2,170	0	227	227
1990	202	555	757	2,314	392	2,706	0	75	75
1991	509	388	897	2,111	303	2,414	0	227	227
1992	148	103	251	2,592	582	3,174	0	213	213
1993	152	171	323	2,361	329	2,690	0	37	37
1994	289	197	486	1,745	261	2,006	8	69	77
1995	580	1,044	1,624	1,745	682	2,427	83	527	610
1996	448	650	1,098	1,204	157	1,361	56	9	65
Averages									
76-96	298	352	650	3,043	461	3,504	9	133	142
87-96	273	400	673	1,869	373	2,242	15	163	177
1997	232	298	530	484	36	520	5	0	5
E2	232	298	530	484	36	520	5	0	5
% of ave	0.850	0.746	0.788	0.259	0.097	0.232	0.340	0.000	0.028

Appendix D.12. Taku River (above border) coho salmon run size, 1987-1997.

THE 1997 DATA ARE PRELIMINARY

	Canadian Catch			Above Border		
Year	Commercia	Food	Test	Escapement	Run	
1987	5,599	113	807	55,457	61,976 a	
1988	3,123	98	422	39,450	43,093 b	
1989	2,876	146	1,011	56,808	60,841 c	
1990	3,207	6	472	72,196	75,881 d	
1991	3,415	20	2,004	127,484	132,923	
1992	4,077	187	1,277	84,853	90,394 e	
1993	3,033	8	1,593	109,457	114,091 f	
1994	14,531	162	0	96,343	111,036 g	
1995	13,629	109	0	55,710	69,448 h	
1996	5,028	24	0	44,635	49,687 I	80,937
Averages						
87-96	5,852	87	759	74,239	80,937	
1997	2,903	96	0	38,632	41,631 I	
	2,903	0	0	38,632	41,631	
% of ave	0.496			0.520	0.514	

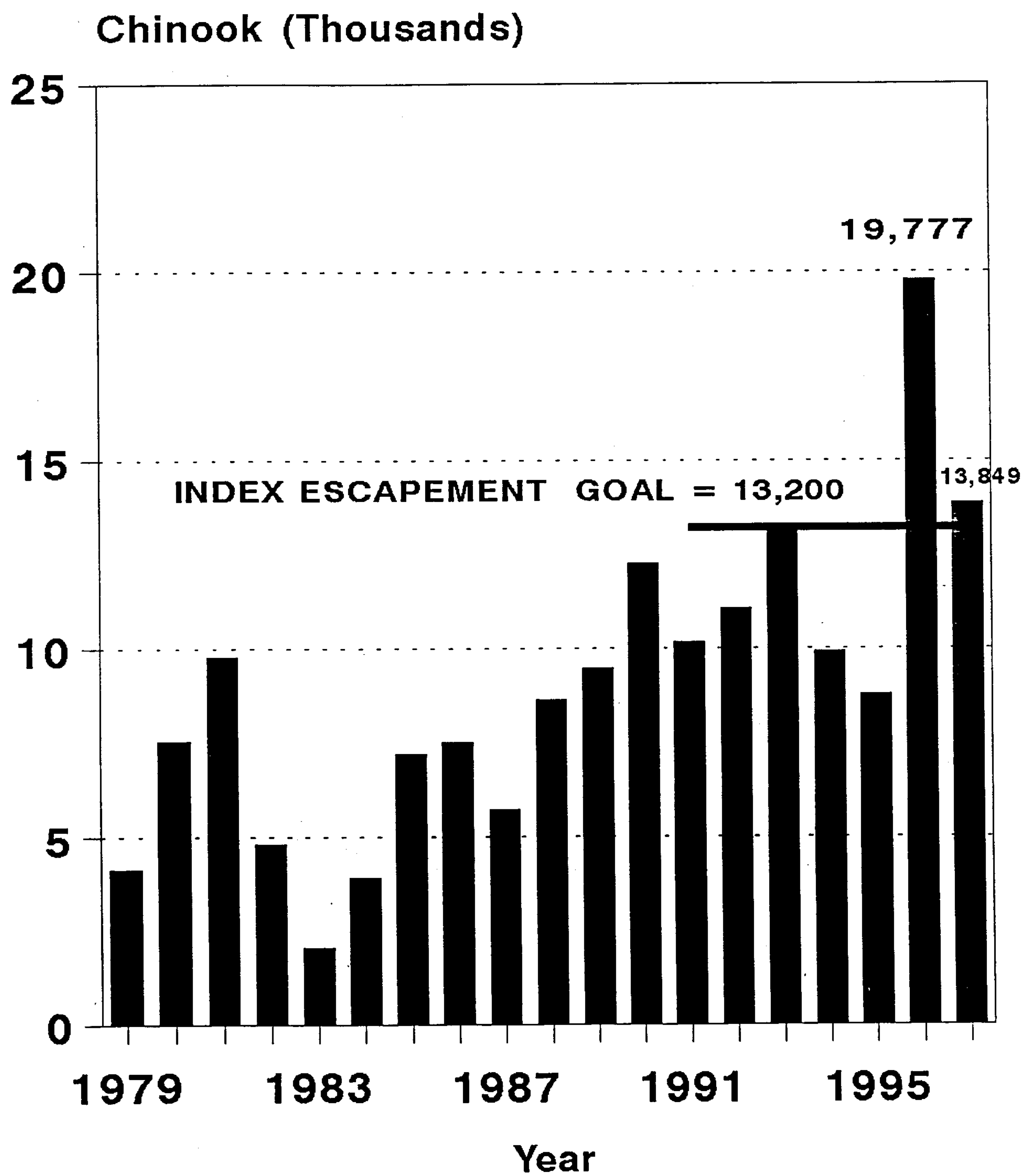
D9

Appendix D.9. Taku River sockeye salmon run size, 1984-1997. Run estimate does not include spawning escapements below the U.S./ Canada border. The early season sockeye expansion is based on the proportion of fish wheel sockeye catch that occurs before the fishery opens.

THE 1997 DATA ARE PRELIMINARY

	Above Border M-R				Expanded				
	Run	Start	Expansion		Run	Canadian		U.S.	Total
Year	Estimate	Date	Method	Factor	Estimate	Catch	Escape.	Catch a	Run
1984	133,414	17-Jun	Ave.(88-90&95-96) FW CPUE	0.056	141,254	27,292	113,962	58,543	199,796
1985	118,160	16-Jun	Ave.(88-90&95-96) FW CPUE	0.047	123,974	14,411	109,563	76,323	200,297
1986	104,162	22-Jun	Ave.(88-90&95-96) FW CPUE	0.095	115,045	14,939	100,106	60,934	175,980
1987	87,554	21-Jun	Ave.(88-90&95-96) FW CPUE	0.088	96,023	13,887	82,136	55,154	151,178
1988	86,629	19-Jun	1988 FW CPUE	0.065	92,641	12,967	79,674	25,811	118,452
1989	99,467	18-Jun	1989 FW CPUE	0.128	114,068	18,805	95,263	64,200	178,268
1990	117,385	10-Jun	1990 CPUE	0.002	117,573	21,474	96,099	110,225	227,798
1991	153,773	9-Jun	Ave.(88-90&95-96) FW CPUE	0.007	154,873	25,380	129,493	105,637	260,510
1992	162,003	21-Jun	Ave.(88-90&95-96) FW CPUE	0.032	167,376	29,862	137,514	124,410	291,786
1993	138,523	13-Jun	Ave.(88-90&95-96) FW CPUE	0.026	142,148	33,523	108,625	143,261	285,409
1994	129,119	12-Jun	Ave.(88-90&95-96) FW CPUE	0.019	131,580	29,001	102,579	99,047	230,627
1995	145,264	11-Jun	1995 FW CPUE	0.008	146,450	32,711	113,739	93,066	239,516
1996	132,322	9-Jun	1996 FW CPUE	0.017	134,651	42,025	92,626	190,184	324,835
Averages									
84-96					129,050	24,329	104,721	92,830	221,881
87-96					129,738	25,964	103,775	101,099	230,838
1997	96,781		1997 FW CPUE	0.036	100,364	24,595	75,769	71,094	171,458
	96,781				100,364		75,769		
% of ave					0.778		0.724	71,094	

CHINOOK ESCAPEMENT TO TAKU INDEX AREAS
Aerial Counts to Six Tributaries, 1979-97



- excludes jacks.
- Pop. estimates from m/r were 69,300 in 1995 (33.8K large, 32.2K med. and 3.2K small)
- M/R estimates of large chinook in 1989 & 1990 were 40,300 and 52,100; aerial surveys = 24.5% of run